TECHNICAL FILE

1769
XLII

1/-

FLIGHT

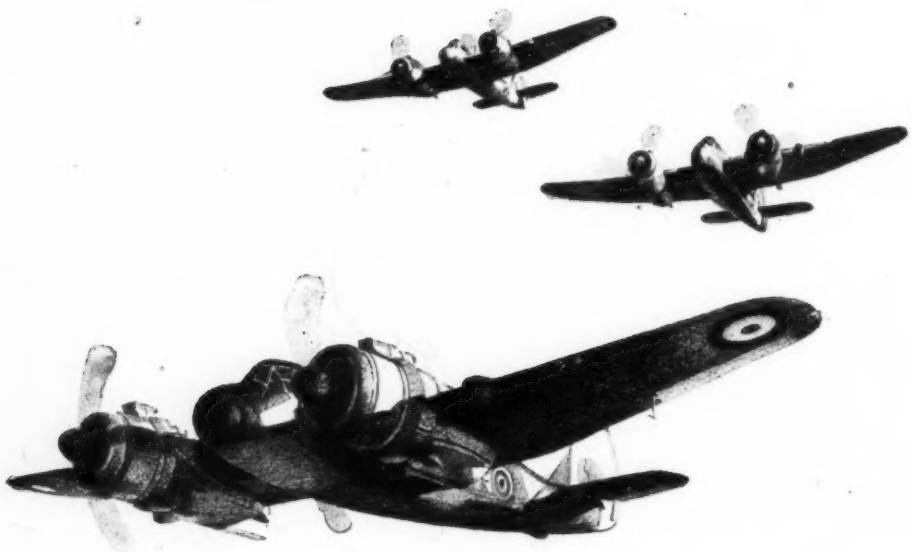
and THE AIRCRAFT ENGINEER

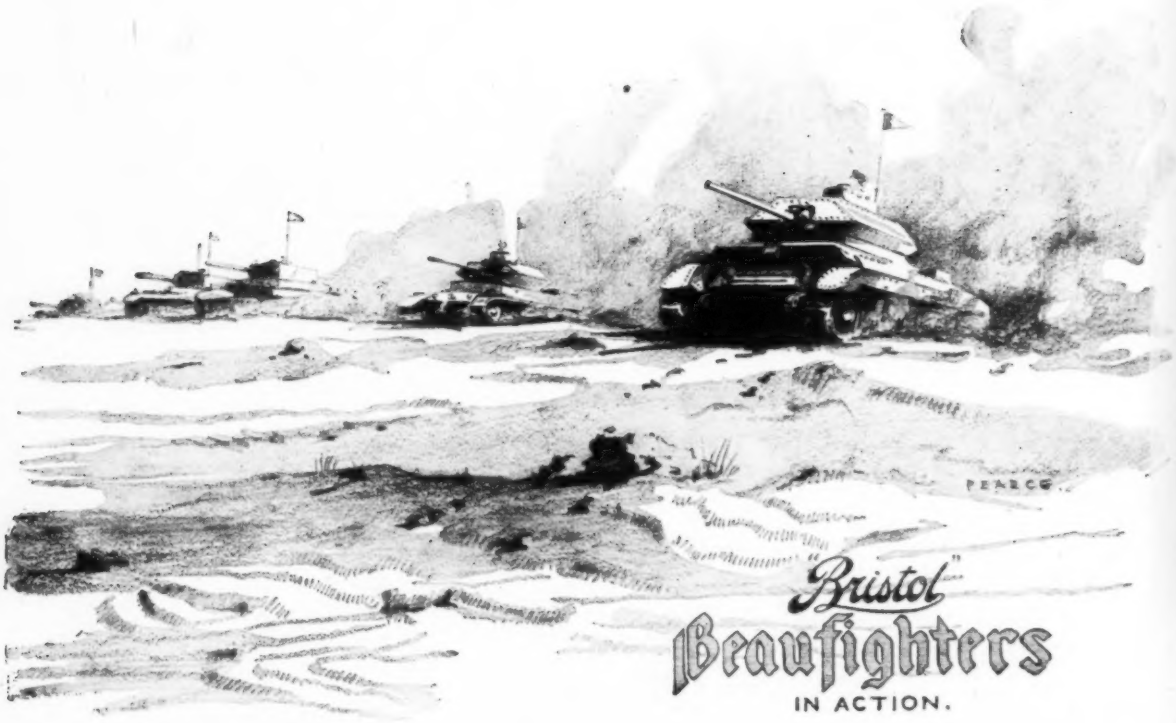
OFFICIAL ORGAN OF THE ROYAL AERO CLUB

OCTOBER 8th, 1942

RECEIVED
NOV 2 1942
CHIEF ENGR'S
OFFICE

Blackburn
AIRCRAFT





THE BRISTOL AEROPLANE COMPANY LIMITED.

FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

Editor C. M. POULSEN

Managing Editor G. GEOFFREY SMITH, M.B.E.

Chief Photographer JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY :	BIRMINGHAM, 2 :	MANCHESTER, 3 :	GLASGOW, C.2 :
8-10, CORPORATION ST.,	GUILDHALL BUILDINGS, NAVIGATION ST.	260, DEANSGATE,	268, RENFIELD ST.,
Telegrams: Autocar, Coventry.	*Telegrams*: Autopress, Birmingham.	*Telegrams*: Iliffe, Manchester.	*Telegrams*: Iliffe, Glasgow.
Telephone: Coventry 5210.	*Telephone*: Midland 2971 (5 lines).	*Telephone*: Blackfriars 4412.	*Telephone*: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1763. Vol. XLII. October 8th, 1942. Thursdays, One Shilling.

The Outlook

German Moral

"THE direct destructive effect of the enemy air raids did not correspond with the resources expended for this purpose. On the other hand, the indirect effect, namely, falling off in production of war industries, and also the breaking down of the moral resistance of the nation, cannot be too seriously estimated."

These words were written by a German, General Grosskreutz, in 1928, and they refer to the operations of the Independent Air Force in the last year of the last war. Yet in 1918 British and French bombers only dropped 7,117 bombs on German territory, and compared with the monsters used to-day they were trifling crackers, more suitable for Guy Fawkes Day than for serious war. The conclusion would seem to be that the present policy of Bomber Command ought to reduce German civilian *moral* to a state of pulp in a very short time. There are many people in this country who eagerly expect that it will.

It is a bad and often dangerous thing for civilians of a nation at war to become obsessed with an idea which will sooner or later produce disappointment and reaction. It was most probably for that reason that the Foreign Secretary, Mr. Eden, said last week that it was a mistake to speak of our bombing offensive as if its object were to frighten the German. The object was not to frighten him but to paralyse him, and make him incapable of further harm.

Perhaps it was the same desire to throw cold water on recklessly optimistic hopes which prompted the diplomatic correspondent of *The Times* to give prominence a few days later to the report of a neutral who had just visited Germany and the occupied parts of Russia. This person, described as a man of wide political experience, said that on the whole the German people are determined to fight through to the end, and that many still believed in victory. The force of the R.A.F. raids, said this neutral, is commonly discussed, and it is recognised that Germany has only had a foretaste of what is to come. Yet the spirit of the German people is still good, though the sheer physical strain of long months of overwork is making itself felt. The spirit of the German army was also stated to be good.

This report goes to confirm the wisdom of the Government and the Air Ministry in adopting the policy of striking at the material fabric of German war production, and never attempting to find a short cut to victory by "striking at nerve centres"—as the phrase used to run in the inter-war years. For some reason or other the German people are evidently prepared to endure more now than they were in 1918. Naturally in a place which has been raided as Cologne and other cities have been, the inhabitants are filled with dismay, and there has been an exodus from such places of all who were able to quit. But there is no sign that a breakdown of German *moral* will force Hitler to sue for peace. So long as his armies will fight as desperately as they are now fighting in Russia, it would be folly for us to expect any such ending to the war.

Hitler now spends little time or trouble in trying to stimulate German civilians. He spoke in Berlin last week, mentioning that it was a year since he had last spoken there. His speech was largely a recital of German victories, and he allowed that to produce its own effect. He can rely confidently on civilian *moral* until his armies are beaten.

It will be wise for the British people to cling to Mr. Eden's words, and to think only of paralysing the enemy. The chances of doing any good by frightening him are remote.

Aid for Russia

"AS compared with the aid which the Soviet Union is giving to the Allies by drawing upon itself the main forces of the German Fascist armies, the Allies' aid to the Soviet Union has so far been little effective." This statement by M. Stalin, in reply to a questionnaire by the A.P. Moscow correspondent, places the whole matter of the aid of the Allies to Russia in its proper perspective. "As compared with," etc., is the significant part of the sentence. M. Stalin did not infer that the convoys sent to northern Russia represent in themselves insignificant aid. But compared with what Russia is doing for the Allies, it is little enough.

No one in Great Britain will think other than well of M. Stalin for his outspoken statement. Mr. Churchill voiced the general feeling when he said, after his return from Russia, "The Russians do not think that we or the Americans have done enough so far to take the weight off them. This is not at all surprising in view of the terrific onslaught which they are withstanding with such marvellous tenacity."

It appears fairly obvious that we cannot do very much more than we are doing in the way of shipping material to Russia. The opening of that much-discussed second front would be one way, but only those few in the different Governments who are in possession of all the facts are in a position to judge when and where the Allied offensive shall be started.

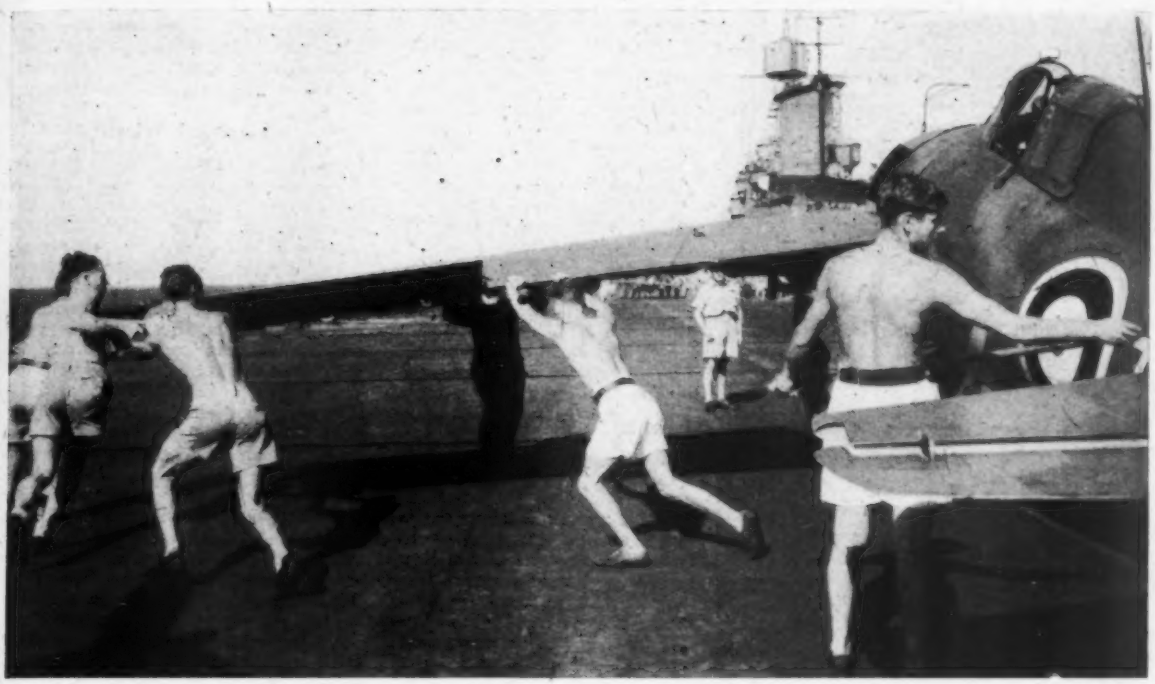
One would have imagined that there must be some intermediate steps which, without committing this country to a full-scale campaign for which the time may not be propitious, would bring real aid to Russia in her terrific struggle. It is difficult to believe that Great Britain could not, for the sake of argument, spare some twenty squadrons of fighters for the Russian front. Such a force, perhaps composed of Hurricane fighter-bombers, could be kept available to go into action at any point where it was most needed. Just now, Stalingrad is the most obvious, and it would scarcely be argued that the presence of such help could fail to be of very material aid to the Russians. The Stukas and other *Luftwaffe* types at Stalingrad would be considerably subdued if they were faced with a strong force of British fighters in addition to the Soviet air forces. Germany has made us familiar, in all theatres of war, with the use of a heavy concentration of forces in one locality to serve as an irresistible battering ram by overcoming all local opposition. A Royal Air Force unit of a size commensurate with our present strength in the air could be held in readiness to concentrate on any particular area which the Russian high command might designate.

Not the least valuable aspect of such aid would be the moral effect on the Russian ground forces when they saw with their own eyes the very real aid which England was giving them. Goering would almost certainly be compelled to transfer still more fighter squadrons from the western to the eastern front, and this would in turn help our Bomber Command by reducing the opposition met on our raids in the west.

CONTENTS

The Outlook	379
War in the Air	381
Here and There	384
The *Luftwaffe* in Russia	385
Eagles Repatriated	389
Desert "Retrievers"	390
Aircraft Characteristics	390, a and b
Preparing for a Career	391
Behind the Lines	394
D.H. Engine Development	395
Book Reviews	396
Cockpit Contamination	397
Correspondence	400
Service Aviation	401

SHADOWING: A Short Sunderland of Coastal Command on the look-out for enemy shipping and submarines proceeding to or from their area of operations.



A Grumman Martlet being ranged on the flight deck of the 23,000-ton aircraft carrier H.M.S. *Formidable.*

War in the Air

The Stalingrad Struggle : Australian Advance in New Guinea : Eighth Army Strikes in Egypt

THE struggle in various parts of Russia, and particularly in Stalingrad, continues to amaze the world. It is little profit to discuss the frenzied fighting amidst the ruins of the city, and prophecies as to what will be the position a few days hence are futile. Where the opposing infantry are locked in fighting for buildings and streets, obviously aircraft can play no part, but in the surrounding country the superior strength in numbers of the *Luftwaffe* gives the Germans a great advantage. When the Germans attack, the Russians depend mostly on their artillery to drive back the tanks and infantry, but the gunners have to endure dive-bombing and low-bombing from the air before the panzers advance. German tanks seldom advance without air support. The Red fighters do all that men can do to check the German bombers, but the numbers of the latter tell. German reinforcements are often brought up in transport aircraft.

On other fronts in Russia air strength appears to be more equally divided. Besieged Leningrad recently claimed that 36 German machines were shot down in one day, 19 by fighters from the Red Air Force and from the Baltic Fleet, and 17 by anti-aircraft gunners. The proportions are unusual, and as no report has been made of the number of Russian fighters lost, one cannot draw any conclusions as to how the air fighting went.

Down in the south, likewise, one reads that the aircraft of the Russian Black Sea Fleet have been bombing villages held by the enemy. No doubt aircraft are equally active on that distant front where the Russians are resolutely holding the town of Mozdok and the approaches to the Grozny oil-fields, but fewer details come from there. It is legitimate to conclude that there the Russians have a better position in the air. Not having such good communications as the Germans, either in roads and railways or in air transport,

"VON MOTTEN ZERFRESSEN" : A German pilot surveys the result of some good shooting by British ground defences.

WAR IN THE AIR

SPERRY-DIRECTED: A stick of bombs falling from the racks of a Fortress. It is interesting to note the differences in gap between the missiles which is caused by slight inaccuracies in the automatic electric release.

the Russians cannot move their squadrons from place to place so readily as the Germans are able to do. The transport aircraft has certainly come into its own in this year's Eastern campaign.

The Germans claim to have bombed the port and city of Astrakhan at the mouth of the river Volga on the Caspian Sea. No doubt the object was to interfere with Russian transport of oil and supplies from Persia up the Volga.

New Guinea

IT is always cheering to hear of troops of the United Nations taking the initiative, even though it be on a small scale. This applies particularly to the war against Japan, for at the beginning the enemy seized the initiative in every direction, and for a long time, far too long, continued to advance without a check. There have been no more Japanese advances for a considerable time past, and gradually the Allies, having held him, are beginning to push him back. The Australians have started an advance on the summit of the Owen Stanley range in New Guinea, and have met with some success. The number of troops employed on each side is necessarily small, for the country is very difficult, and large forces could not be supplied. In those wooded jungles the fighting is not mechanised in character, except for the mechanism of small arms. In the air above, the bombers give what support they can. This can only take the form of attacks on communications and supplies, and particularly on the bridges which make the jungle tracks usable. One bridge has been frequently mentioned; it is called Wairopi, which is said to be the native way of pronouncing "wire-rope" bridge. It seems a petty target for the great American Fortresses, but its distance from their base probably explains their employment. If there were an air base sufficiently near, probably Blenheims could deal with Wairopi well enough. One must, however, remember the capacity of Fortresses to defend themselves when attacked by Japanese fighters, and American air losses have been astonishingly low in that area. The heavy bombers have greatly reduced the utility of this bridge. Japanese bases in New Guinea have also been bombed.

Catalinas have been sent to bomb airfields in the Solomons, places called Buin and Buka being named. At the first the damage done was believed to be extensive, but the results of the simultaneous raid on Buka were not observed. None of the Catalinas was lost.

Beaufighters built in Australia have lately been in action against the Japanese in New Guinea, and also Douglas A20 attack-bombers.

It is too early yet to say that there is a chance of expelling the Japanese from New Guinea, but the great thing is that they have not been able to occupy Port Moresby, and now they are farther off from it than they were a fortnight ago. The continuous bombing of their bases by the Americans and Australians must certainly make their position far from comfortable. Australia is being defended mainly by bomber aircraft.

ALL LIT UP: Tobruk at night illuminated by a flash bomb to take this photograph. Flak was very quiet. The one streak is coming from the fuse of the flash bomb.

A Desert Battle

WITH the passing of September, weather should be getting favourable for campaigning in the desert, though before long the troops on both sides will have to endure considerable heat by day and uncomfortable cold by night. General Montgomery has told us all over the wireless that the life in the desert is very healthy and that the Eighth Army, at the end of the hot weather, is very fit. The airmen, of course, or at least the air crews, can get out of the burning heat of the day, but they have to put up with the cold of the nights just as the infantry have to do. In the last war, and perhaps to some extent in temperate climates in this war, life at Air Force stations included a degree of comfort and even luxury which the infantryman was inclined to envy. That does not apply to air stations out in the desert, where the messes are anything but luxurious. The standard meal is often salty tea and bully beef.

Exactly why Rommel went over to Berlin when Hitler made his recent speech has not been explained, but it is likely that he wanted to set forth to him the problems of the position in Egypt. It seems most probable that lately more aircraft have been sent across to the Axis there, despite the claims of the Russian front. Still, the Eighth Army continues to hold superiority in the air, and from all accounts the co-operation between its air squadrons and its ground troops is growing ever closer and more effective.

The last day of September saw a British attack in the early morning on some strong points held by the enemy opposite the centre of the British position. These were captured after brisk fighting, and counter-attacks were

WAR IN THE AIR

ENEMY AIR LOSSES TO OCT. 3rd.

	Over G.B.	Over Continent	Middle East
Sept. 27	0	0	2
,, 28	0	0	2
,, 29	0	0	2
,, 30	3	0	3
Oct. 1	0	0	6
,, 2	0	18	7
,, 3	0	0	0
	3	18	22

Totals: West, 6,371; Middle East over 4,595.

repelled. Enemy air activity was greater than it has been before, but Allied aircraft gave close support to the British ground troops. So far as it went, it was a highly satisfactory little battle.

The Aleutian Islands

IN the first half dozen years after the last war there was a vogue among adventurous pilots for trying to fly round the world. There were failures by Blake and Norman Macmillan, due to a mechanical breakdown; by Maclaren, who flew into something hard; and by four American Army pilots who set out in Douglas two-seaters, and of whom two completed the round trip. In those days the Aleutian Islands figured prominently in the news, and readers got out their atlases and looked up the unfamiliar names. Since then little has been heard of this semicircle of islands, which seem to be the tops of a submerged mountain range connecting North America with North Asia, until the Japanese seized two of the group, Kiska and Attu, in the present war. They may have meant to use them as bases for raids against Alaska and Canada, but more probably they wished to have outposts against a North American air attack on the homeland of Nippon.

Now the United States is setting methodically to work to recover lost ground. The U.S. Navy, of course, is the chief actor in this drama, and it has to take Army troops along with it. The air corps of both Services naturally have important shares in the business. It must be a most unpleasant job for the air crews (it is not too simple for the ships) to cruise off to the Aleutians, for the North Pacific shares with the most northerly area of the Atlantic an intense propensity for fogs. For some time past U.S. Army long-range bombers have been facing all the risks and unpleasantnesses connected with fog to bomb Japanese shipping in the harbours of the occupied islands and installations on the shore, but these raids meant long and difficult flights.

Quite lately the Americans pushed forward in some strength to gain air bases nearer to their objectives. A very large convoy with powerful naval escort made its way to the Andreanos group in the Aleutians, and arrived without sighting an enemy aircraft or submarine. The troops were landed from the transports on to one or more of the islands, and at once set to work to construct an airfield. On the fourth day an experimental landing was made on the field, and after ten days it was reported as ready to take fighters and transport machines. The Andreanos group is not much over 100 miles from Kiska, and so will make it much easier for the Americans to interfere with Japanese warlike operations there.

The Japanese cannot be much exhilarated by the knowledge that America is pushing nearer to Nippon, and the President of Tokyo University has made a broadcast, saying that, "contrary to our expectations, our enemies seem to be fighting back at us by regaining their footing, and are now fighting back with their whole hearts." His broadcast was worded so as to be calculated to produce the maximum depression in Japan, and he even spoke of the possibility of a "terrible end." General Tojo cannot have given much thought to the "end" when he attacked the United States and declared war on the British Empire, and in this case the old saying, "better late than never," hardly applies.

DRAMA: Inside the Flying Control room of an intruder station on a busy night.

BRITISH & U.S. AIR LOSSES TO OCT. 3rd.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent Ftrs.	Middle East A'crft.
Sept. 26		(not reported before)	11	
,, 27	0	0	0	1
,, 28	0	0	0	2
,, 29	0	0	0	2
,, 30	0	0	0	2
Oct. 1	0	17	0	0
,, 2	0	0	6	0
,, 3	0	7	0	0
	0	24	17	7

Totals: West, 4,723; Middle East, about 1 725.

AT MIDWAY: A Grumman Avenger torpedo-bomber returns with sundry scars after contact with the Japanese navy. The top rear armament is of interest. It appears to be a power-operated Sperry spherical turret with two .5in. machine guns.

HERE AND THERE

Colleagues' Donation

A DONATION of £50, as a memorial to the late E. R. Staniland, who was killed when an experimental aircraft in which he was flying crashed last month, has been made by his colleagues at the Bristol Aeroplane Co., Ltd.

Staniland had been an experimental test-flight observer on Bristol engines for several years.

Busman's Holiday

SO popular are the American-built Mustangs with the pilots of a Polish squadron operating with R.A.F. Army Co-operation Command that, according to an official Air Ministry news item, one pilot who was due to go on leave just after he got his new Mustang decided to stay and enjoy his holiday in the cockpit.

What a testimonial!

Sunderland Sweep

HERE'S a true story from West Africa.

An injured Sunderland captain, rescued from a dinghy, arrived in hospital with nothing but a 10s. note and an American dollar in his possession.

Fellow patients, mostly Army officers, sympathetically suggested a game of cards to help pass the time. The flight lieutenant thanked them and said how about a hand at poker?

When the evening's play closed, the "destitute" victim of enemy action was feeling lots better. He'd won £6 10s. from the Army!

Postmen to Keep Look Out

LIVES of members of air crews have sometimes been lost because of the delay in locating their aircraft when they have crashed in lonely places.

Sometimes postmen are the only persons who pass through such isolated districts, so they have been asked by the Air Ministry to maintain a careful watch while on their rounds and to report to the police any crashed craft they see.

Postmen on duty, however, will not take part in searches, for that would involve delay in delivering letters, some of which might be of outstanding importance.

TO BUILD SHIPS WITH WINGS: "Can Do" Kaiser, as they now call him in America, holding a luncheon conference with aircraft chiefs on the building of "sky freighters." Left to right are, Grover Loening (War Production Board consultant) Glenn L. Martin, Donald W. Douglas, Henry J. Kaiser and John K. Northrop.

Contract for Kaiser

A CONTRACT for three experimental seven-engined twin-hull flying boats, each capable of carrying 60 tons of freight, has been awarded by the U.S. Government to Henry J. Kaiser, the "miracle-man" shipbuilder who recently launched a Liberty cargo ship ten days after its keel was laid—and claimed he could even improve on that!

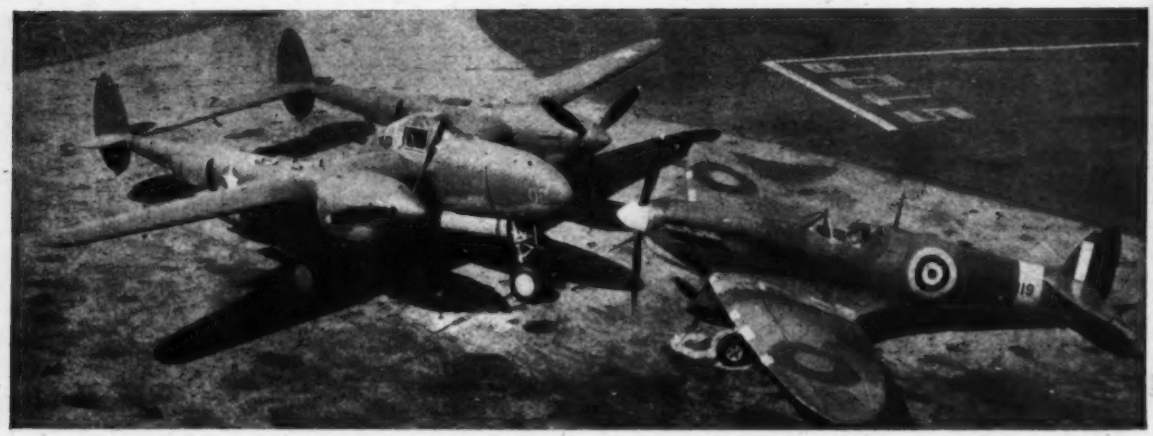
If these three flying boats are proved satisfactory, more will be ordered, and Kaiser has been asked to draw up plans for their mass production. The value of the initial contract is put at £4,500,000. Incidentally, it seems an ironical coincidence that the name "Kaiser" should be so prominently connected with the fight against Germany in this war.

Official Appointment

THE Ministry of Supply announce the appointment of Mr. George Briggs as Deputy Controller in Charge of Iron and Steel Supplies. He succeeds Sir John Duncanson, the newly appointed Iron and Steel Controller. In his new post Mr. Briggs will be directly responsible for the supply of iron and steel products to all the war industries.

Mr. Briggs has been with the Iron and Steel Control since the outbreak of war, where he has been responsible for the production of alloy and special steels, steel castings, forgings and ferro-alloys, in which work he has been closely associated with the new Controller. Mr. Briggs has held the post of Director for Alloy and Special Steels and Assistant Controller of Iron and Steel Supplies.

Before the outbreak of war Mr. Briggs was special director of English Steel Corporation, Ltd., and a director of the Darlington Forge, Ltd.



HOWDY, NEIGHBOUR!: A Spitfire meets a Lightning when paying a visit to the Lockheed air terminal at Burbank, California. "This historic handshaking of the two champion defenders of democracy," says the official caption, "took place when Col. Ben Kelsey, of the U.S. Army Air Forces, flew in from Wright-Field."

THE *LUFTWAFFE* IN RUSSIA

Air Forces in Close Support : The Stukas : German Losses : The Battle for Stalingrad

By V. L. GRUBERG

IN an attempt to describe the air fighting on the Russian front one comes up against innumerable obstacles. The absence of coherent information ; the vast expanse of the front ; the continuous wide employment of air forces by both parties, and the fluctuating character of air battles make it difficult to pick up one main thread and follow it throughout the campaign. It is wiser to follow the battle on the ground, stopping here and there where the air forces have played a major rôle in the fate of the battle, and to place on record such methods of air warfare as have developed in the bitter struggle of Russia's Air Force against the *Luftwaffe*.

The forces employed by the *Luftwaffe* on the Russian front are composed of the air fleet commanded by General Keller, which operates in the northern sector and is supported by Finnish air units ; the fourth air fleet under Generals Loehr and Pflugbeil, which operates in the centre and the south is supported by Italian Croatian fighter units and reconnaissance units under General v. Richthofen. The radius of operation of General Keller's units extends north up to the White Sea, and in addition to the operations on the land front, these units are engaged on interfering with Russian transport in that area. Fighter squadrons, dive bomber units and bombers comprise the strength of *Luftwaffe* in both sectors. Air Fleet V (General Stumpff) deals with shipping in the northern sector.

Throughout the campaign the decisive interference of the air weapon in the ground battles is a most marked feature of the fighting. It would not be an exaggeration to suggest that the powerful support which the *Luftwaffe* has continuously accorded to the panzer divisions and to the infantry has been primarily responsible for the advance of the German masses.

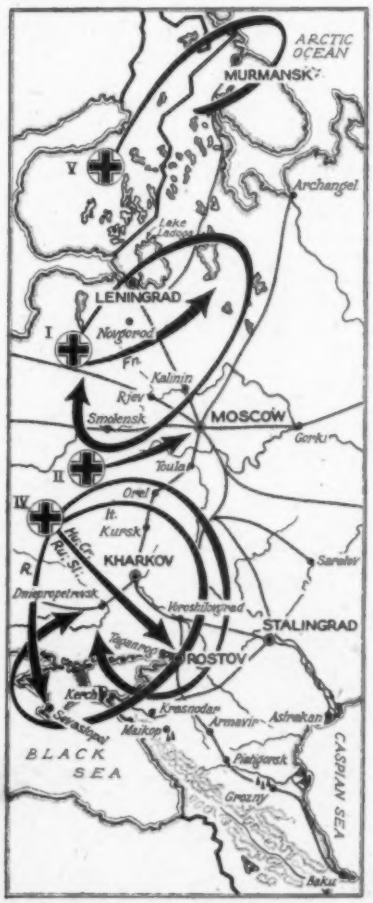
The Soviet Air Force has, of course, sapped a lot of the *Luftwaffe's* strength. But once again it has been proved here that the effectiveness of close air support is at its best in an offensive ; conversely it is less effective in defensive operations, such as the Russians are fighting in the South.

Luftwaffe's Advantage

While air support is, of course, vitally necessary for both parties, it is the inherent qualities of the air weapon which give the attacker a serious advantage, for he can plan his targets, strike at the advanced airfields of the enemy and, having the initiative, he can change the grouping of the battle forces and concentrate his effort on preselected sectors. The defender is thus placed at a disadvantage which he can only counter by a more skilful and elastic employment of his air forces.

That the Russians have mastered the art of tactical elasticity is evident from the destruction wrought by the Soviet Air Force on the *Luftwaffe* and the German ground forces. Some idea of the losses suffered by the Germans at the hands of the Russian Air Force can be gathered from the diagram, which covers only a relatively short period of fighting. Considering that the advantages were with the *Luftwaffe*, and that the concentration of their air units exceeds anything hitherto experienced in a ground combat, the fight put up by the Soviet Air Force is a great credit to the planning, resourcefulness and fighting spirit of our Allies.

The Germans fully grasped the potential advantages of the *Luftwaffe* in the offensive. Units, fast and independent of rail or road communications, could appear at the right time and in the desired sectors without long marching movements or previous concentrations. Their official spokesman recognises two important conditions which enabled the army to develop its full offensive. Writing in the *Neues Wiener Tageblatt* on August 18th, General Quade says : "The incessant exploitation of the surprise element by the *Luftwaffe* was one of the pre-conditions of the good initial results of the offensive. A further reason was the scouting work of the air reconnaissance units." Indeed the rôle played by these units deserves special mention, for it is quite evident from German reports that great importance is being attached to their work by the German High Command.



LUFTWAFFE IN RUSSIA : Roman figures, Air Fleets ; arrows, operational sectors. Attached to Air Fleet IV is V. Greim and Richthofen Corps (R). Foreign Units : Cr. (Croatian) ; Fn. (Finnish) ; Hu. (Hungarian) ; It. (Italian) ; Ru. (Rumanian) ; Sl. (Slovakian).

Preparing for the Offensive

On the Russian front the task of this branch of the *Luftwaffe* was found to be particularly arduous, for the Russians are masters in camouflage and "discreet" military movements. To quote a German commentator, the reconnaissance units "had a significantly difficult task to fulfil in view of the brilliantly camouflaged Russian system of field fortifications and strong points." More will be said about these formations in dealing with the battle for Sevastopol, where their work is reported to have been of special importance.

The main tactical employment of the *Luftwaffe* in the initial stages of the offensive was in giving the ground forces maximum support (by attacking Russian field fortifications) and protecting them from the attacks of the Soviet Air Force. Parallel to these two main operational tasks, units of the *Luftwaffe* were detailed to interfere with and, whenever possible, to destroy Russian supply and communication lines in order to prevent an effective re-grouping of the Russian ground forces.

After the German break-through at Kharkov and Kursk, *Luftwaffe* units were used in mass employment to support the ground troops in crossing the river Don, while simultaneous air attacks on Russian supply columns in the Ilmen Sea sector, and attacks on railway traffic and supply points west of Moscow, were reported in a communiqué from Hitler's Field Headquarters on July 5th.

The latter operations could only be

THE *LUFTWAFFE* IN RUSSIA

undertaken at night, Russian fighter opposition and A.A. defences being too efficient to allow the *Luftwaffe* to approach the objectives in the daytime. The centre of gravity of *Luftwaffe* operations in July was directed towards the Don. A German version of these operations was given in a statement issued by the German High Command and published in the *Berliner Börsen Zeitung*. It claimed that "constant reconnaissance has foiled the attempts of the Russians to concentrate heavy tanks and artillery units north of Voronezh to reach the western banks of the river and recapture the town. This reconnaissance made possible the non-stop employment of bomber and Stuka aircraft. The operations of these *Luftwaffe* units, designed as defensive measures against Russian attacks, were continued each day with undiminished violence and prevented the recapture of Voronezh by the enemy."

THE WORK OF THE STUKAS: Fort Maxim Gorki, an important bastion of the Sevastopol defences smashed by a concentrated attack of dive-bombers.

The Air Arm in Ground Battle

Germans reports thus attribute to the *Luftwaffe* a major share in the operations in the Don sector; they go even so far as to suggest that "by means of these continuous, violent air attacks the enemy was beaten to such an extent that in some places in the north and north-east sector of Voronezh several localities were taken in counter-attack."

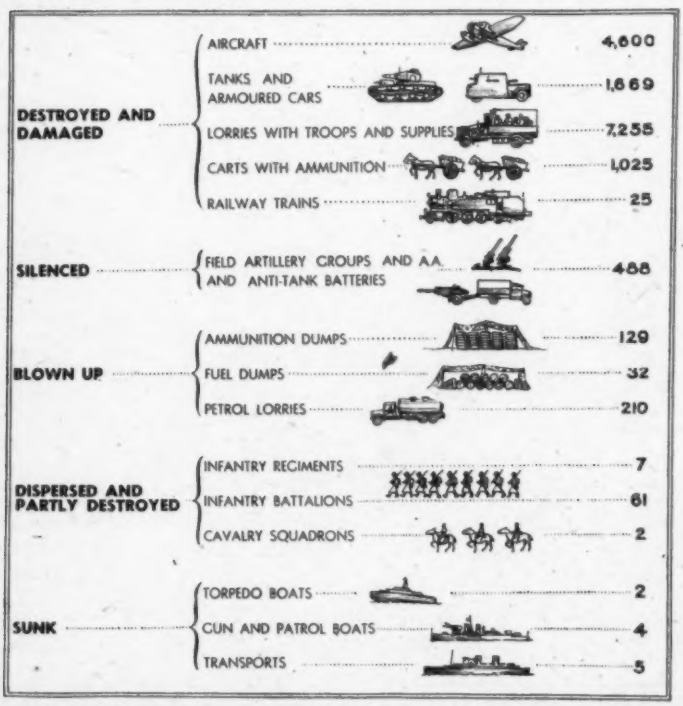
Not only is it thus officially admitted by the Germans that it was mainly due to their air forces that their panzer and infantry units could make any progress; this is also acknowledged by the Russians. The decisive rôle of the *Luftwaffe* in the Don offensive is confirmed by *Isvestya*, and it is apparent that the Germans had in this sector a decisive numerical superiority in the air and did not lack co-operation between the air forces and the panzer and infantry units.

Commenting on the operations, *Pravda* wrote on July 30th: "The Air Force is displaying great activity in the present fighting. Air battles take place day and night. In the last two months alone the *Luftwaffe* has lost no fewer than 3,000 aircraft. But despite such colossal losses the enemy force is still strong and active, and the fight against it remains one of our *most fundamental* tasks."

In the fighting for bridgeheads on the Don river the *Luftwaffe* appears to have taken a leading part. The task of their units was to smash the way for the panzers and the infantry, to help them to establish bridgeheads on the eastern bank, and to frustrate an orderly Russian withdrawal to new lines of defence on the eastern banks of the river.

In this latter task the Germans saw an opportunity to put into practice the theoretical concept that it is just in the pursuit of the enemy that the air weapon has the most worthwhile objectives. "Whoever wants to detach himself from the enemy's main force is compelled to use the highways, at least with the bulk of motor transports. Such movement is likely to create congestion even on approaches to bridges, and thus offers a most suitable target for the dive-bomber."

Innumerable dive-bombers were, in fact, thrown into the battle by the *Luftwaffe*. But although they certainly inflicted heavy losses on the Russians, the morale of the troops was far from broken. In contrast to their experience on previous battlefields, Stuka pilots here found themselves facing an opponent on the ground who not only refused to be intimidated, but who developed ingenious defences, employing small arms, machine-guns and anti-tank guns in combating the dive-bomber peril. One of the ingenious and very effective methods developed by some Russian infantry units was the setting up of special machine-gun A.A. groups.



RUSSIA'S AIR FORCE AT WORK: The diagram shows a summary of losses inflicted on Hitler's armies from June 27th to September 10th, 1942.

Soviet Air Force Hits Back

The opposition in the air encountered by the *Luftwaffe* also proved formidable. Soviet fighters took a heavy toll of German dive-bombers; so much so that the *Luftwaffe* was forced to employ fighter escorts for their Stukas. Italian formations equipped with Macchi C200 and 202 fighters were assigned to this task and suffered heavy losses in their encounters with Soviet fighters.

The blows delivered by Soviet fighter units to the Italian formations wrested an unusual compliment from Italian sources. A despatch of the official Stefani Agency, published on July 30th in the *Tribuna*, says that squadrons

RUSSIA'S DEADLY WEAPON. The MIG-3 fighter which is extensively used by the Russian Air Force has contributed largely to German losses in the air and on the ground.

of the *Regia Aeronautica*, equipped with Macchi fighters escorting Stukas, met the Mig and Yak fighters, and "Russian pilots have given proof of outstanding fighting qualities surpassing anything met hitherto."

Yet throughout the past few months the main feature of the air-fighting remains the close-support work of the air unit in the battle. Writing on the tasks of the Air Force, *Pravda* says: "The most important force of the German land army is tanks. Concentrating them on a narrow sector, the Germans try to break through our defences. The most important task of our Stormoviks, fighters and bombers, is skilfully to seek out concentrations of enemy tanks and mechanised troops, to destroy panzers, guns, machine-guns and lorries, and to disperse enemy forces concentrated in strong points." Figures of German losses in equipment caused by operations of Soviet air units are the best evidence that this tactical principle has been most successfully carried out in practice.

The Dive-bomber's Share

In the battles on the Russian front both belligerents thus employ very similar tactics, and while numerical superiority is held occasionally by one side or the other, both the Russians and the Germans acknowledge the decisive importance of the air arm in the ground battle. From the fates of the tremendous battles so valiantly fought by the Russian forces one can also see that successes of such air operations are most striking in offensive actions, such as the Russian attacks in the Voronezh sector and the German drive in the south.

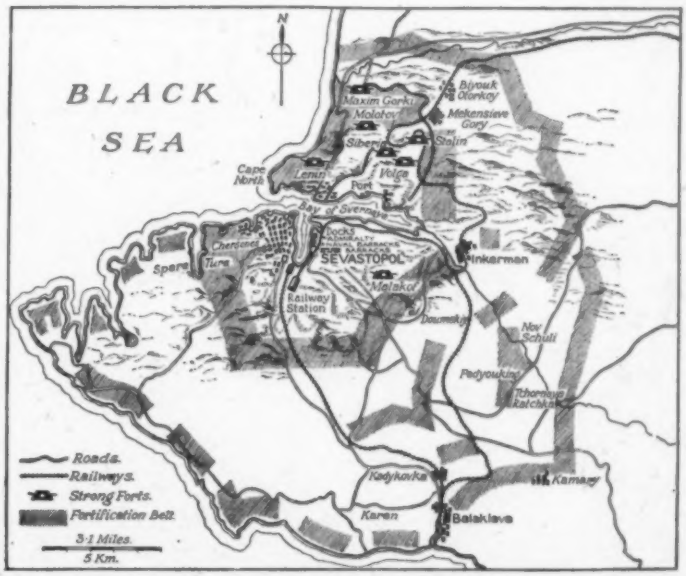
The dive-bomber continues to remain the *Luftwaffe's* chief weapon in interfering in the ground battle; it came into special prominence in offensive operations against heavy fortifications. There was nothing new in this. In the storming of the French defences on the Meuse, 650 dive-bombers were employed to hammer Fort Boncelle at Liége, plastering it for six hours with bombs of the heaviest calibre and then enforcing its capture.

But the greatest test for the dive-bomber versus fortifications was on the Russian front, primarily in the battle for Sevastopol. With unsurpassed skill the Russians made good use of the favourable topography for the construction of mighty fortifications. Brilliantly placed strong points in the outer defences were so cleverly concealed in the landscape that they had to be pointed out to German correspondents visiting the site after its capture. The defensive strength of the deep trench system was reinforced by built-in gun nests, while the inner defence ring, described by the Germans as unique, consisted of Forts Stalin, Siberia, Lenin and Maxim Gorki, a 50ft. hill with an armoured cupola containing four 30-cm. guns.

The Battle for Sevastopol

Völkischer Beobachter of July 6th, 1942, writes that the Russian gun crews "fired their guns until the very last moment at 100 m. range on the storming German infantry." Here again armed reconnaissance operations of the "Short Range Reconnaissance Corps (Nahkampf-fliegerkorps) under Colonel-General v. Richthofen have rendered the Wehrmacht invaluable service. It is mainly these attacks that in many cases have made it possible for the army units to move against the strong fortifications, and they have saved a lot of blood of the infantry and the Pioneers—who had to face here the hardest battle since the beginning of the war."

Another important weapon extensively employed by the *Luftwaffe* in this battle was the flak artillery (a component of the *Luftwaffe*) which was widely used in advanced positions for bombarding field fortifications and strong points. Special "Flak Battle Groups" were organised, composed usually of a heavy calibre gun and a light battery. While the artillery remains for quite a time in their positions, these F.B. Groups send their guns forward, close behind the first lines of the infantry, and shell the enemy's points of resistance at point-blank range. Since they are mostly without cover, they soon attract the attention of the entire enemy artillery.



The fortifications of Sevastopol which for 25 days withstood the mass attack of the *Luftwaffe*.

THE *LUFTWAFFE* IN RUSSIA

During the siege of Sevastopol these F.B. groups poured 180,000 volleys on the fortifications but suffered particularly heavy losses since, as the German report admits, "Russian artillery fire covers here almost every yard of terrain." Suffering these heavy losses, the *Luftwaffe* threw in their main weapon, the Stukas and "battle units." In collaboration with the F.B.G.s, Stukas were employed to break up gun positions and to silence artillery points. Accepting heavy losses they were also employed to silence Russian A.A. artillery, while at the same time persevering with their major objective—the destruction of fortifications.

This twofold task of *Luftwaffe* units in this sector, the preparation for the infantry assault and the hitting-out at the centres of opposition, formed the main feature of the German assault on Sevastopol. For 25 days bombers and Stuka aircraft hammered unceasingly at the forts of Sevastopol. They are reported to have dropped 24,000 tons of bombs on the fortress and are said to be largely responsible for the Russian evacuation of the town.

Efficiency of Stukas

The efficiency of the Stukas was demonstrated by the destruction of the eastern turret of the Maxim Gorki fort. Only then did it become possible for German infantry to storm it. Heavy losses were accepted by the *Luftwaffe* in these mass operations of Stukas; these were only possible because of the advantage of nearby airfields. While this fact in no way minimises the results scored by the Stuka units, or their contribution to the battle, it is important in the correct evaluation of this weapon.

With the intensification of the German drive towards the Caucasus and Stalingrad, air operations entered a new phase. While the activities of the *Luftwaffe* still primarily centred on the support of the ground forces, strategic bombing operations now increased in volume and intensity. They were mainly focused on the communication lines in the rear of the Russians, such as the Novorossisk-Stalingrad line which stretches over a distance of some 390 miles.

Along this line, which crosses the connection from Baku to Rostov, important supplies are carried for different regions of Russia, such as oil, cement, building materials and cereals. The cutting of this line was, therefore, considered to be the *Luftwaffe's* most important objective, particularly in view of oil transports. For this latter reason *Luftwaffe* bombers also attempted to interfere with the Volga shipping as an alternative transport route of the Caucasian oil. Soviet Air Force units, however, prevented the *Luftwaffe* from seriously interfering with the shipping on the Volga and the communication lines in the rear, and in these operations little success was scored.

Before Stalingrad

In the Caucasian mountains and passes the Germans found it difficult to employ their Stukas effectively. The narrow width of the valleys and the necessity of operating in narrow gaps between high mountains did not, however, prevent the Russian Air Force from fully employing their fighter and dive-bomber units. Under these difficult conditions Russian units, equipped with the Mig-3 fighter, had to dive and attack, often in spaces hardly wide enough for the manœuvre of their aircraft. This advantage may yet be an important deterrent in the German push in this sector.

In the thrust across the open steppe, Stuka units continued to operate in masses. The resolute fight put up by Russian ground forces took the heart out of German infantry and panzer units. Without air support—writes a Russian military commentator—"the Germans do not venture a step," and to accord this support the *Luftwaffe* went over to wholesale sector zone bombing. The battle area is thoroughly bombed sector by sector, and the ground forces advance behind a bomb curtain, much like an artillery barrage.

The *Berliner Börsen-Zeitung* (September 19th, 1942) gave the following description of the *Luftwaffe's* assault on Stalingrad: "Immediately above the Panzer units the 'destroyers' and 'battle' aircraft bombed and fired their weapons. Above them flew the 'H' reconnaissance (short-range reconnaissance) aircraft, and still higher the Stukas with the fighter escorts. Frequently the rising columns of smoke interfered with the work of the *Luftwaffe*. Stukas dived close to each other and soared by passing fighters. One had to be careful to avoid collisions."

This mass employment was possible because of the rapid setting up of advanced airfields in the closest proximity to the battle area. At one time, in the initial stage of the attack, the Russians appear to have been short of adequate fighters in this sector, for the *Luftwaffe* managed to push their landing fields well forward from which Stukas were employed on a kind of *shuttle service*. After fighter reinforcements had been brought up, the Soviet Air Force continued to take a heavy toll of the Stukas, while at the same time paying due attention to the bombing of the airfields. These operations were accompanied by strategic bombing of the German rear, designed to reduce the speed with which the German reserves and supplies were brought to the front.

Winter Prospects

But even the zone-bombing tactics did not appreciably accelerate the advance of the enemy. In one of the operations German aircraft dropped leaflets over Stalingrad, announcing in no uncertain words the capture of the town by August 25th. Like so many other German promises, this one was not kept, and the German forces continued to battle for the possession of the city. Meanwhile, the battle on the ground, which has moved from the open steppe to the built-up area of the town, presents new difficulties to the German supporting air units. For the close hand-to-hand and tank-to-tank fighting must unavoidably restrict the mass employment of aircraft.

This may not only give the valiant defenders some respite, but also provide the Soviet Air Force with a better opportunity of pushing the operational airfields of the *Luftwaffe* more to the rear. As it is, the *Luftwaffe* advance airfields in the open country in this sector are highly vulnerable. Should Russian resistance continue to bar the Germans from further progress, the setting-in of winter conditions may ground the *Luftwaffe* or force them to retire to more habitable areas. For already now the frosts at night are most painfully felt by the Germans, and air operations depend here more on the weather than in many other parts of the world. One can safely assume that Goering and General Milch—who is the *Luftwaffe's* Comptroller of Equipment—will be better prepared for a winter campaign this year than last. They must have learned a lesson from their experience last winter. But just because they now know the enemy they are fighting, and may expect their strength to be taxed elsewhere, they will undoubtedly strain all their resources to stabilise the position before the approaching winter.

Plastics in Aircraft

IN the second of his articles on "Plastics in Aircraft," published in *Flight* of Sept. 24th, Mr. W. Nichols, referring to the Duramold process, mentions that phenolic resin, fluxing at about 280 degrees F., is used, and he comments that due to the high temperature employed, the rubber bag or blanket will deteriorate in time.

S. R. Delvin, managing director of Catalin, Ltd., has written to point out that two firms in this country, Merrons, Ltd., and Renn's Shaped Ply, Ltd., produce shapes using one of the Catacol phenolic adhesives developed more than two years ago.

This range of resins is available in varying grades and for setting at temperatures ranging from room temperature upwards, but the one generally preferred by users of the rubber bag process in this country sets at about 150 degrees F.

The last parade in R.A.F. blue. Air Chief Marshal Sir Sholto Douglas inspecting the Eagle Squadrons before saying goodbye on their transfer to the U.S.A.A.F. Behind him are Maj. Gen. Spaatz, commanding the 8th U.S.A.A.F., and Brig. Gen. Hunter, who commands the American fighter units in Britain.

EAGLES · REPATRIATED

Three Squadrons of United States Volunteers Transferred from the R.A.F. to the U.S.A.A.F.

IN the first year of the war a number of young American pilots came over to Europe and volunteered to fight the Axis in the air without waiting for their own country to declare war.

Some went into the French Armée de l'Air to emulate the famous Lafayette Escadrille of the last war, and others joined the Royal Air Force. Those in the R.A.F. were, at their own request, banded together to form one squadron, which was called the Eagle Squadron. Other volunteers have followed these pioneers, and three Eagle squadrons—Nos. 71, 121 and 133—have been formed. All were fighter squadrons.

Now the United States is in the war, it is natural that they should wish to be with their own people, and all three squadrons were transferred on September 29th to the United States Army Air Forces.

They will form the 4th Pursuit Group under Col. E. W. Anderson. A last parade in the blue uniform of the R.A.F. was held in the morning when Air Marshal Sir Sholto Douglas, K.C.B., M.C., D.F.C., inspected them and said farewell in these words:

"I would have wished that on this my first opportunity of addressing all three Eagle squadrons together on one station that my words should have been other than words of farewell. We of Fighter Command deeply regret this parting, for in the course of the past 18 months we have seen the stuff of which you are made, and we could not ask for better companions with whom to see this fight through to a finish.

"But we realise—as you too must realise—that your present transfer to your own country's air force is, in the long run, in the best interests of our joint cause. The United States Army Air Force's gain is very much the Royal Air Force's loss. The loss to the *Luftwaffe* will no doubt continue as before.

"In the 18 months which have elapsed since your first unit became fully operational, Eagle pilots have destroyed some 73 enemy aircraft—the equivalent of about six squadrons of the *Luftwaffe*—and probably destroyed or damaged a great many more. The actual official total of destroyed is, I believe, 73½, the half being part of a Dornier shared with a British squadron and

The first parade in U.S.A.A.F. khaki. Eagle Squadron pilots lined up to receive their new "wings" from Gen. Hunter.

EAGLES REPATRIATED

a symbol of Anglo-American co-operation. Of the 73½ enemy aircraft destroyed, 41 have been claimed by the Senior Eagle squadron, No. 71—a record of which they may very well be proud, but one which, I understand, the other two squadrons are determined will not long remain unchallenged.

"It is with great personal regret that I to-day say 'Goodbye' to all you boys whom it has been my privilege to command. You joined us readily and of your own free will when our need was greatest and before your country was actually at war with our common enemy. You were the vanguard of that great host of your compatriots who are now helping us to make these Islands a base from which to launch that great offensive which we all desire. You have proved yourselves great fighters and good companions, and we shall watch your future with confidence.

"There are those of your number who are not here to-day—those sons of the United States who were the first to give their lives for their country. We of the R.A.F. no less than yourselves will always remember them with pride. Like their fathers who fought and died with that American vanguard of the last war—the Lafayette squadron—so will those Eagles who fell in combat ever remain the honoured dead of two great nations.

"And now I have some news for you. The Air Council, anxious to give tangible expression to the gratitude which we all feel for the great work you have done, is going to ask each of you to accept a small personal memento of your services to the Royal Air Force. The memento, I understand, will take the form of a medallion and, though it has not been possible in the short time available to have this medallion struck and ready by to-day, it is hoped that its presentation will be made in the very near future.

"I hope these emblems will serve as a pleasant reminder of your comradeship with the Fighter Command of the Royal Air Force—a comradeship which we have been very proud to share and which I, as your Commander-in-Chief, shall always remember with gratitude and affection.

"Goodbye, and thank you, Eagle Squadrons Nos. 71, 121 and 133 of Fighter Command, and good hunting to you, Squadrons of No. 4 Pursuit Group, 8th U.S. Air Force."

They were then welcomed into the U.S.A.A.F. by Maj. Gen. Spaatz and Brig. Gen. Hunter. In the afternoon of the same day the pilots paraded in front of their beloved Spitfire Vs in the khaki uniform of the U.S.A.A.F. and received their new "wings" from the hand of Brig. Gen. Hunter, under whose command they will be.

They wore their British decorations under the American wings on the left breast and, as a special distinction, they wore the R.A.F. wings on the opposite side. The squadrons will still be equipped with Spitfires, and the executive officer of this new 4th Pursuit Group which the squadrons form will be Maj. C. G. Peterson, D.S.O., D.F.C., who has commanded No. 71 squadron, R.A.F., since last November.

DESERT "RETRIEVERS"

R.A.F. Aircraft Salvage Unit in Action

THE efforts of a Royal Air Force corporal working at night with a team of Australian infantrymen have given back two repairable fighter aircraft to our desert air forces. The fighters, a Kittyhawk and a Hurricane, had force-landed in a forward area between our positions and those of the enemy. The pilots had been rescued, and it remained to salvage the aircraft.

"The more difficult of the two to retrieve," said the corporal, who comes from Tunbridge Wells, Kent, "was the Hurricane. It lay near German positions on the far side of some minefields."

The salvage party started off in the evening. They travelled through the minefields guided by a long thread of tape. The Hurricane, they found, was not seriously damaged. It was placed on a trailer and dragged back through the minefields. The Kittyhawk was closer to our own positions. The party drove up to it at night, hoisted it on to a trailer and brought it back. Both of these fighters are now at repair depots, and will soon be flying.

This sort of work is continually being done by aircraft salvage units of the R.A.F. Nor is it only repairable aircraft that they salvage. After most crash landings some parts are still valuable as spares.

In some three weeks, for instance, this corporal and a party of four aircraftmen have brought back good spares or scrap metal from 25 crashed aircraft, some of them enemy planes. They picked up all the metal from one that had crashed just in front of our forward positions without waiting for nightfall. Using only one truck, so as not to be conspicuous, they drove out, hitched on to the wreck and dragged it behind cover of a sandhill, where they took it to pieces and loaded up the metal.

Sometimes aircraft crash in places too close to the enemy for it to be possible for them to be salvaged whole, but even then the men of the salvage unit often contrive to bring in the most valuable parts, the guns, perhaps, or the wireless sets, or those parts of the engines which are most difficult to replace.

One officer of this unit has just returned to base after working for several days on one of our medium bombers that had force-landed almost under the nose of enemy patrols and well to the west of their forward positions. Officially known as Crash Inspector, this officer set off alone a few days ago in a small vehicle with a few tools and a couple of pigeons. The first message the pigeons brought back said that he had stripped the bomber of the most valuable components and taken them to a certain spot in the desert. Could another truck be sent out to collect them, and would it also please bring him a tommy gun, as he was tired of lying in a slit trench strafed by Messerschmitts without being able to fire back?

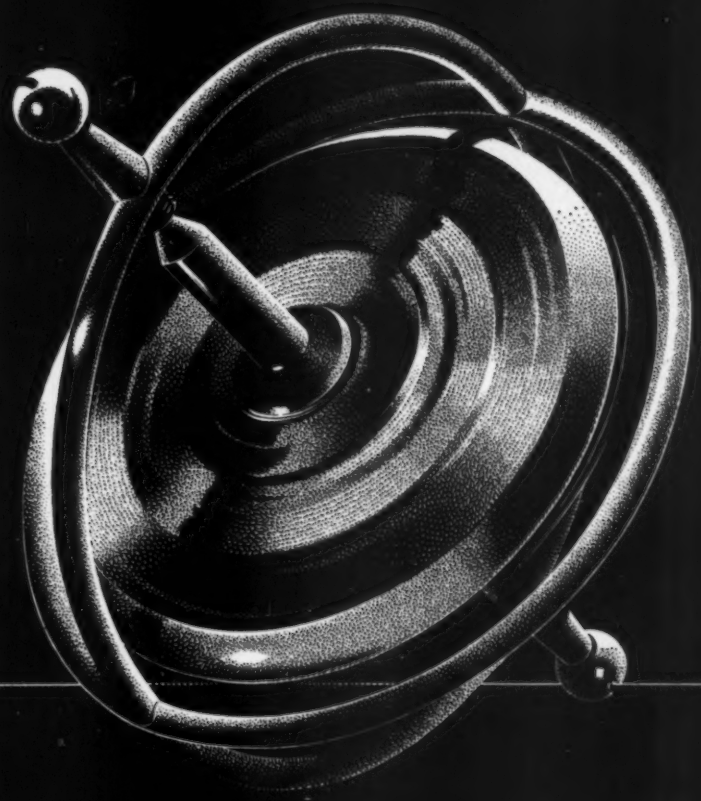
The truck went out, collected the salvaged parts and delivered the tommy gun. The Crash Inspector spent another couple of days or so stripping parts from other crashes in that area and loading them into his vehicle. He did not go back to the bomber because the enemy had put an armoured car guard over it. But from his trench he had a number of satisfactory shots with his tommy gun at Messerschmitts, one of which he may have winged.

Men of the salvage unit were largely responsible for the fact that so few of our aircraft were left behind during the retreat from the Gazala line. Their ingenuity in salvaging abandoned aircraft was extraordinary.

This is the story which they most like to tell:—

One of their parties was sent to a landing ground where it was thought a damaged fighter lay, only to find that it had already been cleared away and sent back. They were about to leave when R.A.F. officers to whom they had reported said, "Just a minute. See that Tomahawk just coming in to land? Looks as though he has been shot up and will have to make a belly landing."

The salvage men at once prepared their cranes. Sure enough the Tomahawk belly-landed. They trundled the cranes out across the landing ground and had a sling beneath the wreck before the pilot could step out of his cockpit. Just a part of the salvage unit service!



BALANCE

THE BALANCING OF A PROPELLER IS VITALLY IMPORTANT . . . CLOSEST POSSIBLE ATTENTION TO DETAIL AND ACCURACY BEING ESSENTIAL

ROTOL
HYDRAULIC & ELECTRIC PROPELLERS

R.A.95.

Seventeenth of the New Recognition Series

AIRCRAFT TYPES AND H

Junkers Ju.52/3m and its Gotha Glider

ORIGINALLY designed in 1932 as a 17-seater passenger airliner, but with the very definite idea of later conversion into something more aggressive, the Ju.52 was one of the most widely used types on the Deutche Luft Hansa routes as well as being popular with a number of other Continental airlines.

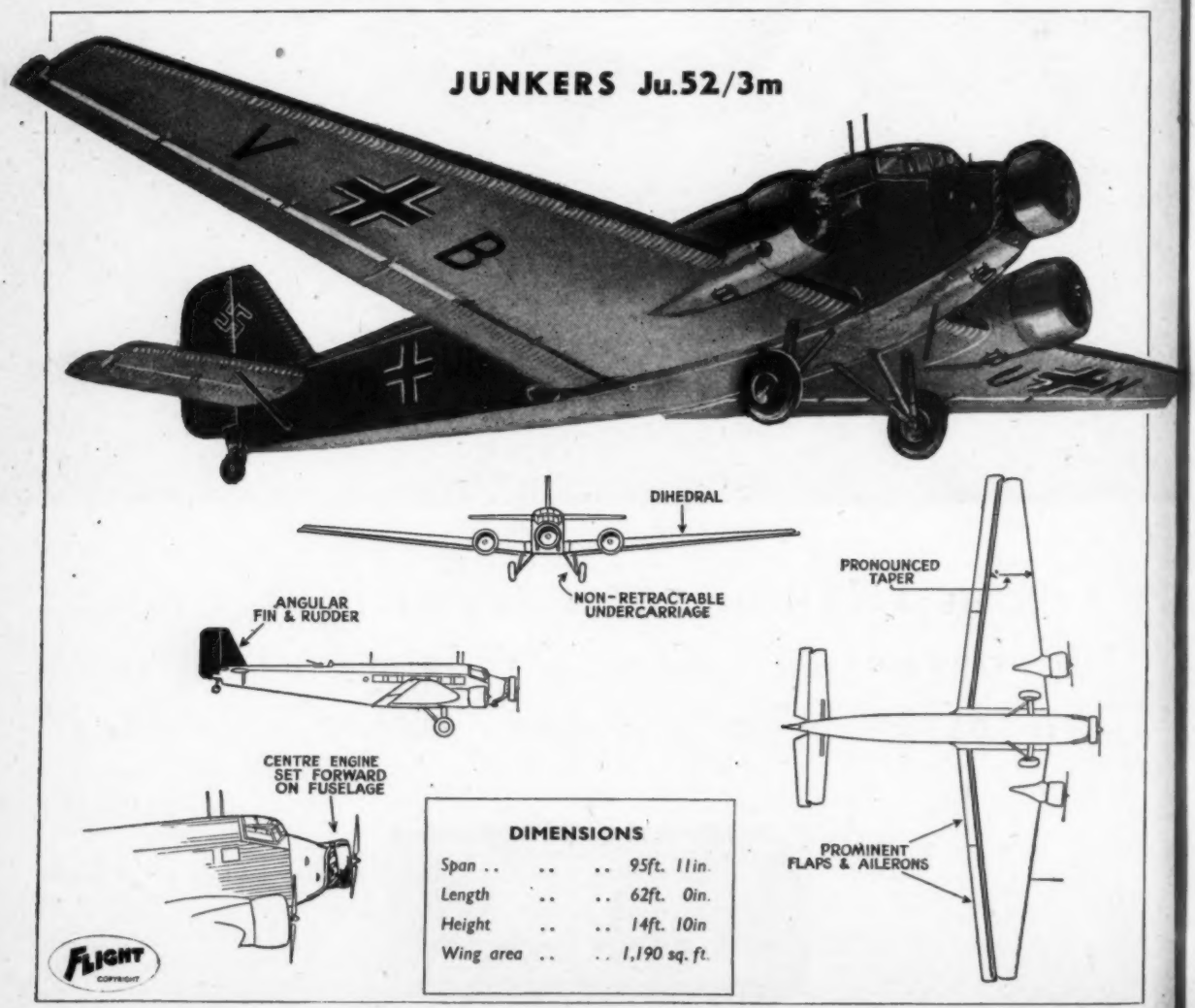
Then in 1935 it was used to equip the newly formed *Luftwaffe* bomber squadrons when Hitler had reached the stage of openly flouting the Versailles Treaty. With the Ju.86, it remained the standard heavy bomber until 1937, when it was relegated to the role of trainer, troop transport, and aerial lorry. It was also the principal type used in the training of parachute troops.

Later came still another role—that of aerial tug for transport gliders; hundreds were employed on this duty for the expensive attack on Crete, and it is still the standard general purpose transport, troop carrier and glider tug in the *Luftwaffe*.

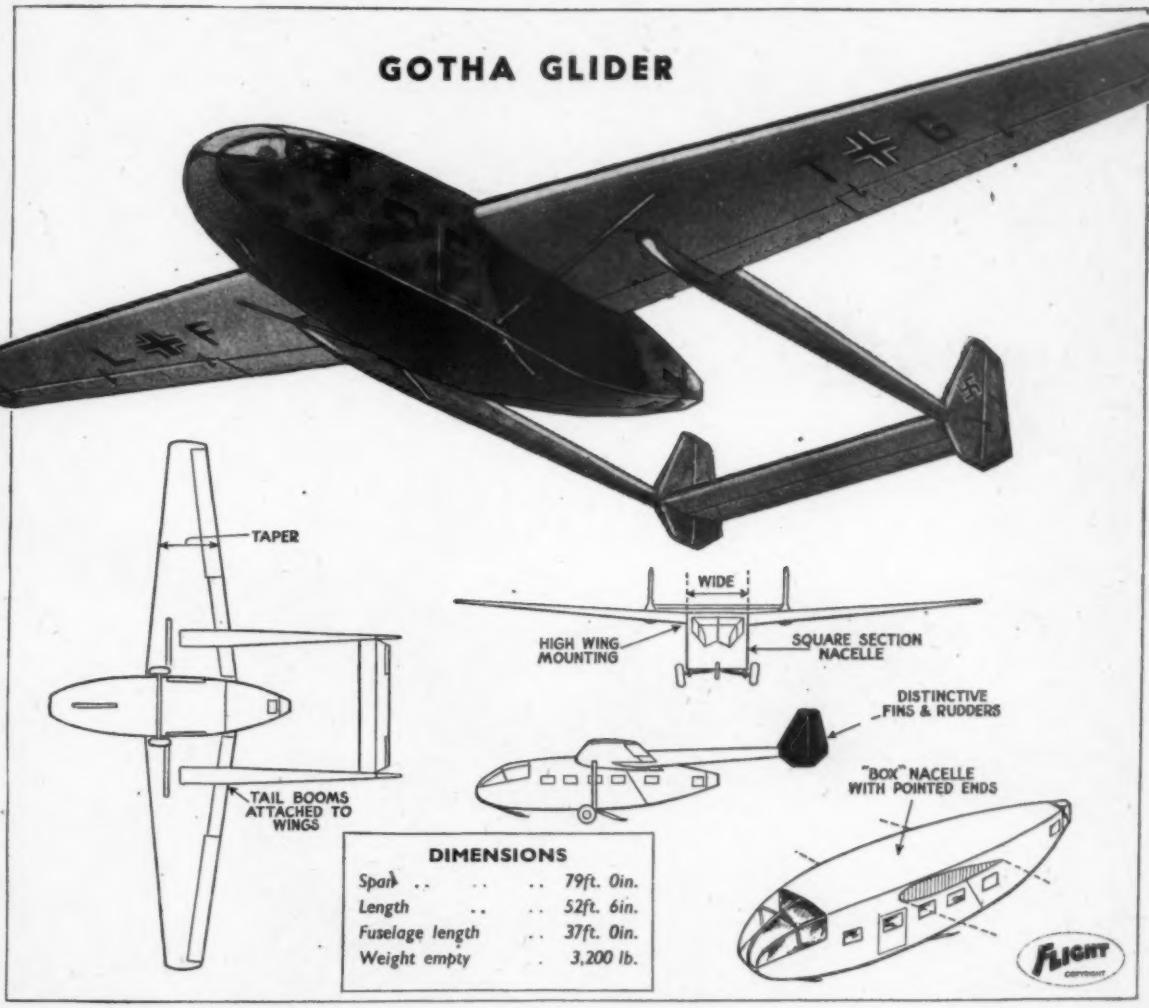
The slab-sided fuselage, with its domed decking, is built up of four longerons with duralumin frames and simple channel-section bracing, the structure being stiffened by a stressed-skin covering of corrugated light alloy sheeting. The centre-section of the low, cantilever wings is part of the fuselage and forms the under-surface of the cabin, the wings being of considerable chord at the roots and tapering on both edges to small square tips, around which project the horn balances of the ailerons. Eight duralumin tube spars, arranged in pairs vertically above each other and braced with short struts, are employed in the construction of the wings, and torsional stiffness is provided by the corrugated metal skin. Flaps of the double-wing kind, which can be varied to increase the effective camber and so increase the lift of the wing, are fitted. A semi-cantilever tailplane, braced with a single strut on each side, has elevators also of the double-wing type.

Three B.M.W. 132D nine-cylinder, air-cooled, radial engines each provide 830 h.p. and armament is limited to four machine guns, one firing forward and operated by the second pilot, one from an open position above the middle of the fuselage and two from the windows on each side.

The top speed of the Ju.52/3m, which has a fixed under-carriage, is 195 m.p.h. at 8,000ft., the cruising speed 170 m.p.h., and the service ceiling 27,000ft. Its normal loaded weight is 22,000 lb.



HEIR CHARACTERISTICS



GERMANY first used gliders to any appreciable extent during the invasion of Crete, and all sorts of somewhat wild stories found their way into the newspapers as to the manner in which they were towed; it was even reported that as many as ten or more were towed in an aerial train behind Junkers Ju.52/3m machines and were cast off on approaching the island one by one—except those which were shot down before they reached the casting-off stage.

But even allowing for the fact that, in that enterprise, a smaller type of glider than that illustrated here was used to land troops in Crete, it is still highly improbable that more than two, or three at the most, could be towed in this way, and it is still more likely that if as many as three were towed by one aircraft, they would not be in tandem but would be attached to three separate tow-lines anchored as widely apart as possible and of different lengths to permit of the gliders flying in staggered formation

The Gotha Go.242, however, is of such a size that it seems next to impossible that a Ju.52/3m could safely manage more than one. Not only would the dimensions of the glider make taking-off with more than one in tow a decidedly doubtful manœuvre requiring an airfield of considerable size, but since the loaded weight of this type is no less than 8,500 lb., it would seem that one such encumbrance would be just about as much as the Junkers tug could be reasonably expected to haul into the air; once in the air, of course, the actual weight of the glider and its freight is not of very great importance, but it has to be got off the ground first!

The Gotha Go.242 is intended to carry no fewer than 23 fully equipped men and was designed by Hans Jakobs; alternatively, it can transport some two tons in freight. Very little precise information is available about its construction, but the frame of its rectangular fuselage is probably of steel tubing and covered with plywood. The high wing is strut-braced to the lower longerons of the fuselage and has a fairly pronounced taper to small square tips. There is a small dihedral angle. Twin booms support the tail, which is of the twin fin and rudder type with a rectangular tailplane between. A single pair of wheels support the aircraft on the ground during take-off but it is probable that these are dropped once it is airborne. This would not only reduce weight and drag, but a skid landing obviously enables the heavily laden glider to get down safely in a much smaller space.

Loading is believed to be by hinging open the rear end of the fuselage where it is possible that a machine gun is also mounted to afford some degree of protection. Two pilots are probably carried and tommy guns could no doubt be used from the side windows.

The LANCASTER

AVRO

A. V. ROE & CO., LIMITED

Part of the machine school of the Bristol Aeroplane Co.

PREPARING FOR A CAREER

An Account of the Training Facilities Offered by the Engine Department of the Bristol Aeroplane Co., Ltd.

TO maintain for over twenty years a position in the world's markets as the leading manufacturers of air-cooled aircraft engines has called for that high quality of craftsmanship which is embodied in every Bristol component no less than for the high standard and originality of Bristol designs.

The company has long recognised the importance of thoroughly sound an efficient training as a contributing factor to the success of its products and as an insurance for the supply of highly skilled men and technicians.

This industry presents a wide scope for pursuing a career in the highest grade of engineering. Whether as designers, administrators, research engineers, or skilled craftsmen in one or other of the specialised production trades, all who are engaged in the development and manufacture of aircraft engines have a definite and individual responsibility for an undertaking in which *quality* always comes first. This all-important factor not only imbues every worker with a healthy pride of craftsmanship; it also results in standards of remuneration which compare very favourably with those in any other branch of engineering.

Aircraft engine manufacture is, moreover, still a comparatively young industry, which is expanding with great rapidity; the demand for skilled executives and artisans may be expected to continue for many years to come. The management of the Bristol Aeroplane Company have always attached the greatest importance to the necessity for organising to meet this increasing need for skilled labour. Twelve years ago a scheme of apprenticeship was instituted, accompanied by works instructional lectures with facilities for attending technical college classes. For some time the applications for apprenticeship far exceeded the annual number of vacancies; but later the vast expansion of the factory resulted in a reorganisation of the whole training scheme on a more extensive scale.

Different Courses

Several different courses of training are comprised in the scheme, according to the general educational stage reached by the candidate. It is advisable to state clearly that, as in other branches of engineering, a full theoretical education offers immense advantages to the youth who aspires to reach the highest technical position in the British aircraft industry.

The Bristol system of training represents an endeavour to find a proper combination of practice and theory by the provision of a properly equipped instructional school *within the works*. Here courses of training are organised, and proper opportunities and inducements are offered to all apprentices and students to further their education and training.

The school is under the direction of a fully qualified principal, who has had wide experience, having been for many years engaged on educational work both in the Army and R.A.F. The carefully selected theoretical and practical staff includes fully qualified specialists, widely experienced in engineering instructional work, who devote their entire time to the school. The practical instructors are men with a broad knowledge of production shop practice and similar work, who are well able to impart their knowledge to the pupils under their charge.

At the present time three courses of instruction are in operation at the Bristol Company's school:—

(1) The Senior Engineering Course.
(2) The Student Apprentice Course.
(3) The Trade Apprentice Course.

1. The Senior Engineering and Col-

PREPARING FOR A CAREER

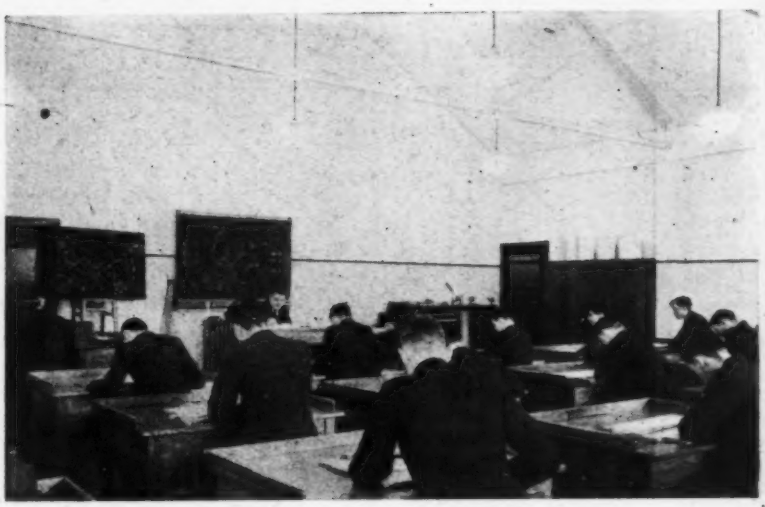
lege Vacation Courses are designed to provide fully adequate aircraft engine works experience. The course is open to graduates and is of two years' duration.

2. The Student Apprenticeship Course offers a very thorough engineering training for youths of 16 to 18 years of age, who have been educated at a public school or secondary school, and who are willing actively to continue their technical studies, parallel with their practical work, for several years.

3. The Trade Apprenticeship Course provides training in the craftsmanship of one or other of the various specialised engineering trades. It is open to suitable boys of 15½ to 16½ years of age from secondary, junior technical, central or elementary schools.

A boy who has not had the advantage of education up to the standard of the School Leaving Certificate is best advised, in the first instance at all events, to seek training as an engineering craftsman. Individual skill in each of the several production trades involved in the aircraft engine industry is of the greatest importance. The Trade Apprenticeship Course is planned with the primary object of producing a regular supply of highly skilled craftsmen in each of these trades. It is, however, associated with a definite scheme of continued theoretical education, which is carried out in the works instructional school. An apprentice who shows diligence and ambition is encouraged by the possibility of rising, through the higher grades of training, to a position of executive responsibility.

The importance which the Bristol Company attaches to the proper co-ordination of practical and theoretical training at all stages is emphasised by the instructional school having been established *within* the works.



In the Bristol school: the drawing classroom.

The courses of training are planned to accommodate all classes, recruited from various sources; and their admittance to a particular course is based on:—

(*a*) Evidence gained during a probationary period when character, ability, aptitude, etc., are assessed.

(*b*) Standard of education already reached.

(*c*) Recommendation of:—

(i) Heads of departments or shops (if already in the company's employ);

(ii) Headmaster of school or college;

(iii) Previous employer.

(*d*) All boys are interviewed and the parent or guardian is invited to be present whenever possible. The course appropriate to the boy is discussed and, if through lack of experience, he is unable to state a preference for any particular trade, he is admitted on probation. After about two months in the instructional school, he is interviewed again.

(*e*) No premiums are accepted, and wages according to agreed rates are paid in all cases.

(*f*) Although a boy may begin with the initial intention of becoming a machinist or a fitter, it is possible for him to progress to a higher grade by application to his work and diligence during his studies for the National Engineering Certificate.

The syllabus of each course is given on the chart on page 34, and an indication of the possible outlets is illustrated.

The value and importance of the instructional school and the efficiency of its organisation are such that the Bristol Aeroplane Company has been recognised by the Board of Education and the Institute of Mechanical Engineers, and appointed as an education authority authorised to conduct National Engineering Examinations up to and including the Ordinary National Certificates. It is believed that the conferring of this distinction on a works instructional school is unique, and it is certainly a great tribute to the efficiency of its management.

Two Main Departments

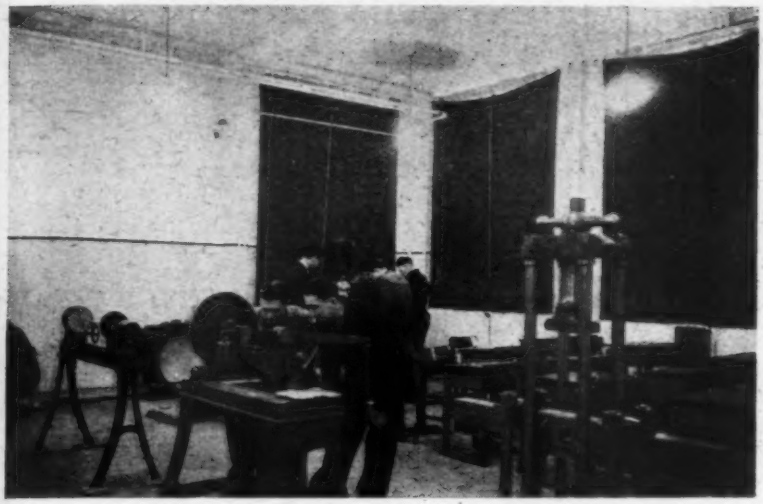
There are two distinct departments of the school, namely:—

(*a*) Practical Workshop;

(*b*) Classrooms and Laboratories.

The practical workshop is well equipped, with lathes, millers, grinders, benches, marking-off table, etc., where 70-75 lads at a time are initiated into factory life and taught the basic principles of machining, toolmaking and fitting. Boys remain in the school for at least six months, following a progressive course and gaining experience on all types of machines, but specialising by spending more time on the machine appropriate to the trade for which aptitude is displayed.

The grinder section of the workshop of the Bristol school.



Boys have their own mechanical engineering laboratory.

The work is of a varied character, covering a wide range and possessing sound training value. On admission, a short time is spent in the inspection and tool section, where the students become acquainted with measuring instruments, and familiar with various tools, drills, cutters, reamers, etc., by issuing them from the stores for use in the school workshops. Students are transferred later to the fitting section and subsequently to the different machines. Boys work to drawings and fine limits, keep notebooks, and from them build up their own reference books.

Educational Groups

There are five distinct educational groups, and boys graduate from one to the other after following a progressive course and passing the qualifying examinations. The classrooms and laboratories are fully equipped and staffed, and a weekly average of nearly 400 apprentices and students attend part-time day classes, receiving tuition in the following subjects:—

Grade of Course	Age of Employees	Subjects
J1 and J2	15—17	Elementary Practical Mathematics. Elementary Drawing. Elementary Science. English. Elementary Workshop Technology.
S1 ...	16—18	Practical Mathematics. Engineering Science. Engineering Drawing. Workshop Technology.
S2 ...	17—19	Practical Mathematics. Engineering Science. Engineering Drawing. Workshop Technology.
S3 ...	18—20	Practical Mathematics. Applied Mechanics, and at least two of the following, one of which must be Heat Engines: Heat Engines. Jig and Tool Drawing. Workshop Technology. Ordinary National Certificate awarded at this stage.

The heat engines and mechanics laboratory is equipped with:—

(1) A 10-ton testing machine which, apart from the normal tests of specimens in tension and compression, may be conveniently used for bending beams, and for the compression of fairly long struts.

(2) A large torsion testing machine for testing short specimens to failure.

(3) A small torsion testing machine for testing long specimens within the elastic limit.

(4) A 6 h.p. Petter two-cycle cold-start diesel engine equipped for measuring b.h.p., i.h.p., cooling losses, fuel consumption, etc.

(5) A 6 h.p. four-stroke cycle petrol engine, with variable compression equipped as above.

Every endeavour is made to give the students an opportunity of learning at first hand from technicians engaged on the company's staff with a view to getting beyond the confines of the syllabus of the National Certificate. Full advantage is therefore taken of the unique facilities which the Bristol company is able to offer as outlined below:—

(*a*) The co-operation of experienced members of the technical staff has been enlisted to link up the theoretical and practical aspects of training; and the following series of lectures has been arranged for students taking their Ordinary National Certificates:—

(*a*) Fuels.
(*b*) Engine temperatures and cooling.
(*c*) Combustion chamber design.
(*d*) Carburettors.
(*e*) Valve and valve gear design.
(*f*) Supercharging.

(*b*) Films loaned by The United Steel Companies Limited on the blast furnace and Bessemer process are used to assist the workshop technology lectures.

(*c*) Visits are paid to the Bristol Company's inspection department to examine up-to-date measuring instruments and gauges.

(*d*) In connection with engineering drawing, up-to-date slides such as those loaned by David Brown and Sons, of Huddersfield, are used to illustrate gear design and manufacture.

(*e*) Practical designing is carried out, including cams for automatic lathes. The students also visit the Bristol Company's jig and tool stores in order to examine and discuss the design of jigs and fixtures actually used in the works.

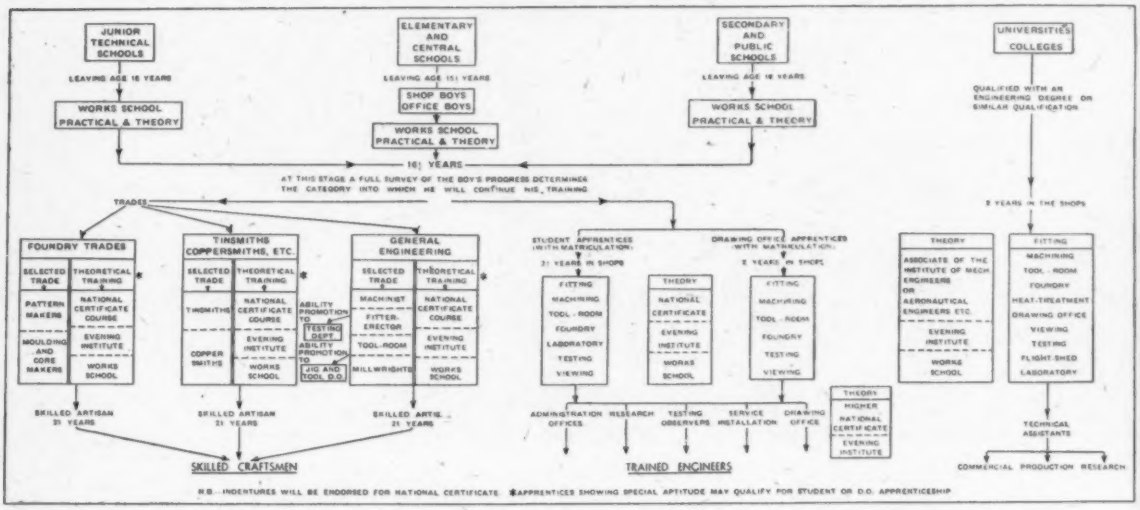
Success

The school is a serious and successful attempt to produce highly trained men who can form the backbone of British aircraft engineering in the shortest and most efficient way. Already past students of the school are making themselves felt in the company's organisation. The co-operation of the Board of Education, and its recognition of the high educational value of the school, is an example of enlightened collaboration in the training of future technicians for the engineering industry, which might well be followed more widely.

Many influential visitors to the

The lathe and milling section of the school workshop.

BRISTOL SCHOOL CURRICULUM FOR APPRENTICES



school have expressed a high opinion of its present and future potentialities, including visitors from Australia and America, and a representative from the Education Department at Washington.

For the benefit of readers whose sons might wish to enter the Bristol school it might be of assistance to point out that in the first instance application should be made by letter to the employment manager, the Bristol Aeroplane Co., Ltd., Aircraft Engine Department. (Letters addressed to the offices of *Flight* will be forwarded.) The age of the candidate should be given, together with his educational stage, i.e., whether elementary school, public or secondary school, college or university. When this information has been received, the appropriate application form will be forwarded for completion.

It has been mentioned that no premium is charged, and that, on the contrary, wages are paid. It may be of interest to mention these briefly. Works apprentices are paid 19s. 11d. at the age of 16, this increasing by steps to 47s. 8d. at the age of 20. In addition, overtime is paid. Staff apprentices start at 18s. at 16, with gradual increases to 48s. at 20.

Junior ex-secondary or public school students receive the same rates of pay as staff apprentices, plus a cost-of-living bonus, and those with senior university degree £4 10s., plus cost-of-living bonus.

In addition, staff apprentices and junior students are eligible for special ability payments.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

A French Engine

THE Sigma Company (*Société Industrielle Générale de Moteurs d'Aviation*) of Saint Etienne have recently completed a prototype of a new aircraft engine, which is now undergoing tests.

This is a radial engine of 28 cylinders in four banks. The Sigma Company, which was formed in 1938, has a considerable experience in the production of aircraft engines, and was originally engaged on the manufacture of Bristol a.c. sleeve valve engines under licence at a plant at Venissieux, near Lyons.

Co-ordination

GERMAN aeronautical research has hitherto been conducted in various institutes separately controlled by the Air Minister, Hermann Goering. To introduce a better co-ordination in the sphere of such researches and to bring in a unified control, a Directorate for Research at the German Air Ministry has been created recently. This "*Forschungsrat des Reichminister's fuer Luftfahrt und Oberbefehlshaber der Luftwaffe*" is in direct charge of all technical research and is responsible for the transmission of research results to the industry and the *Luftwaffe*.

For Nazi Transport

ITALIAN sources report that the *Luftwaffe* has put into service on the Russian front a new type of cargo carrying aircraft. This is said to be a twin-engined type with twin tail booms and a tricycle undercarriage. A spacious fuselage allows the carrying of bulky cargo and the aircraft has a load capacity of seven to eight tons. A special lift-increasing device is said to be fitted on the aircraft which allows operations with full loads from emergency landing fields.

Although no further details are given it is believed that only a few of this type have actually come into service, and the Ju52 is still in mass employment. Incidentally, the new aircraft is said to be the product of a firm other than the Junkers.

Jap Mystery

THE scant information about Japanese aircraft is made worse by language difficulties and a confused designation of types. In this connection it will be remembered that names of Japanese aircraft contain a figure which indicates the year of Japanese reckoning. Thus "00" stands for 2600, the year of the Japanese Era (or 1940). Whether this date indicates the year of the construction of the prototype or that in which the production type went into service is not clear, but one may rather accept the former suggestion.

The full designation of Japanese aircraft is composed of a name, a letter following, and the above mentioned number.

Thus "Nakajima S-97." The first word indicates the manufacturer of a name of the aircraft while the letter stands for the class of service. In this manner fighters are designated by an "S," army light bombers by "KB," medium bombers "B," heavy bombers "OW," torpedo aircraft "G," navy dive-bombers "K," reconnaissance aircraft "H," transport types by a "Y" and training aircraft also by a "K."

This official Japanese designation would greatly help to eliminate the present confusion. There seems to be no reason why this official Jap classification should not be widely adopted outside Japan, in place of the confusing variety of designations at present in practice.

To replace Jap symbols of classification by English ones, e.g., for fighters (instead of "S") would only add to the tangle and serve no logical purpose.

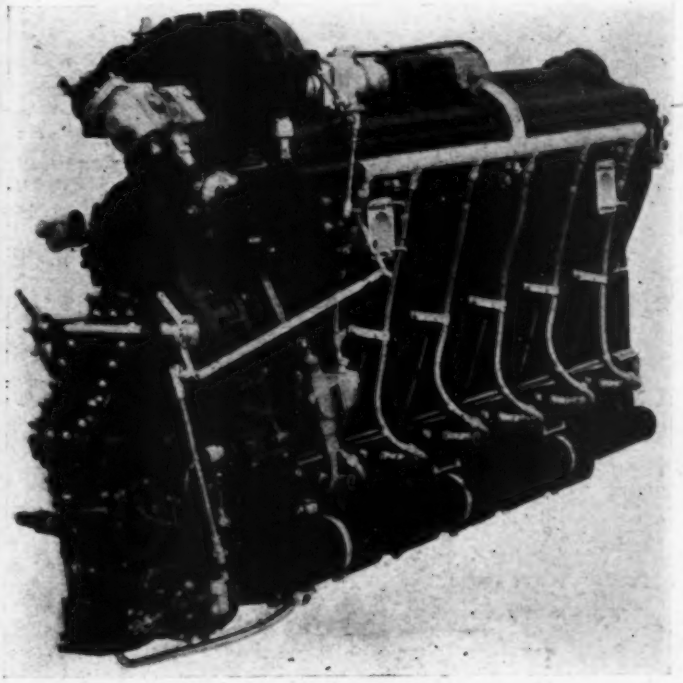
An Airspeed Oxford is being used for flight-testing the new supercharged De Havilland Gipsyqueen IV.

D.H. ENGINE DEVELOPMENT

New Supercharged Version of the Six-cylindered Gipsy Engine

NOTHING has been heard of design developments in the range of Gipsy engines since the war began, but the de Havilland Company has continued with its development work, so far as likely war requirements have indicated. A supercharged version of the Gipsyqueen engine (the R.A.F. name for the Gipsy Six of civilian life) has been under test for some time and, in view of the association of interests between the de Havilland and the Airspeed companies, it is natural that an Airspeed Oxford airframe should have been chosen for flight trials.

Complete details and data of the new supercharged engine, which is called the Gipsy Six III.S (R.A.F. name Gipsyqueen IV) will probably not be released until after the war. Basically, however, it resembles other engines in the Gipsy Six series (the Gipsy Six I for fixed-pitch airscrews and Gipsy Six II for constant-speed airscrews) though its bore has been increased from 118 mm. to 120 mm., and its stroke from 140 mm. to 150 mm. This gives a swept volume of 10.18 litres compared with 9.186 litres. Its dry weight without starter or other accessories is 560 lb. compared with 470 lb. for the Gipsy Six II. Its cruising output is 180 h.p. at 12,000ft.



Three-quarter rear view of the Gipsyqueen IV. The new engine is developed from the Gipsy Six series, but has increased bore and stroke.

The New Engine

The Gipsyqueen IV is a direct-drive engine and normally takes the D.H.1000-size constant-speed airscrew weighing about 70 lb. The supercharger is gear driven and of the centrifugal type and runs at 11.16 crankshaft speed. Automatic boost and mixture controls are incorporated in the carburettor. The dual ignition has the usual harness with integrally screened plugs. The compression ratio is 6.2.

Standard equipment includes a 12-volt starter (which incorporates a hand turning gear), a vane-type fuel pump and a constant-speed governor unit for the airscrew. The engine is fitted with airscoops and baffles. Accessories which can be fitted comprise a hydraulic pump (Lockheed Mk. V) or alternatively an air compressor (B.T H. type A.V.A.), a vacuum pump (type B.3), and a generator (500 watt, 12 volt screened).

Flight trials in the Airspeed Oxford are continuing, but it should be pointed out that, by reason of making use of the existing Cheetah engine-mount attachments, full advantage cannot be taken of the small frontal area.

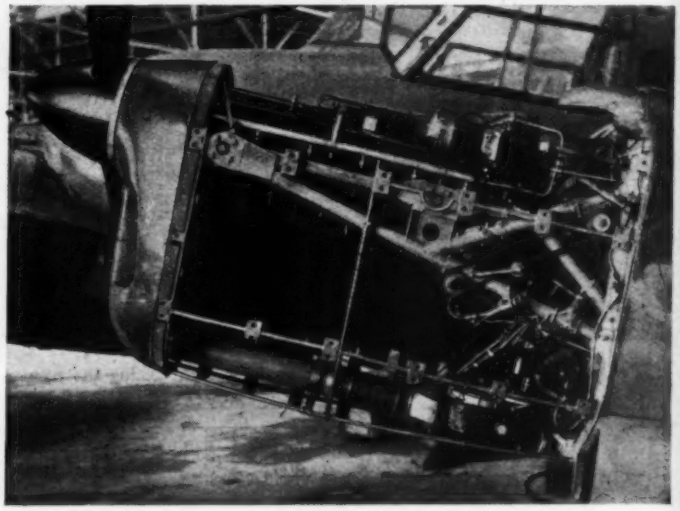
Flight trials so far made indicate that there are no major changes in the handling of the Oxford aircraft but (1) the take-off when compared with the standard Cheetah X version is better, due mainly to the use of constant-speed airscrews, though no unstick data are available as yet; also (2) the acceleration during take-off is smooth and more marked than with the standard Cheetah version, due to the constant-

D.H. ENGINE DEVELOPMENT

speed units allowing better airscrew and engine efficiency during the early stages. Pilots say that the power units are particularly smooth under all conditions of r.p.m.

It may be added that in the matter of ground running the Gipsyqueen IV has done an observed development run of over 100 hours under stripped type-test conditions. A 50-hour weak-mixture run will be made shortly.

Nothing very definite can be said yet about possible applications for the engine except the obvious post-war possibilities in private and light commercial aircraft needing a better performance than the Dragon Rapide or the Percival Q.6. The value of such an engine for training is obvious because it gives the pilots the precise system of controls which they have to experience subsequently with the supercharged military engines. The lack of a supercharger has always been something of a shortcoming from the training point of view.



The Gipsyqueen IV installed in an Airspeed Oxford. Existing Cheetah engine mountings have been retained.

Majors and Sixes

In view of the fact that there appears to be a certain amount of confusion in the aircraft industry concerning the different marks of Gipsy Major and Gipsy Six engines, it may be of assistance to outline briefly their basic differences.

In the Major series, the Gipsy Major I is the original engine, with a compression ratio of 5.25:1 and a power of 130 h.p. This model drives a fixed-pitch airscrew. It is also manufactured by General Motors-Holdens, Ltd., Melbourne, for Australian-built Tiger Moths.

There are two later versions of the Major, one for fixed-pitch airscrews and the other for controllable-pitch airscrews. The former is known as the Gipsy Major IC, has a compression ratio of 6:1 and develops 142 h.p. It is designed for Canadian leaded fuels, and has domed forged pistons and aluminium cylinder heads. This version is fitted in Canadian-built Tiger Moths.

The Gipsy Major II develops 138 h.p. and drives, as already mentioned, a controllable-pitch airscrew. The components have been considerably redesigned for leaded fuels. This engine has not been introduced commercially.

Including the original Gipsy Six I of 200 h.p., there are six variations of the Six series. The 200 h.p. Gipsy Six I corresponds to the Gipsy Major I (fixed-pitch airscrew). The Gipsy Six H.C., of 205 h.p., corresponds to the Major IC, and was designed for Canadian leaded fuels. Another version, the Gipsy Six R, of 224 h.p., was designed for the Comets of the England-Australia race, and only a few were built.

From the Gipsy Six H.C. was developed the Gipsyqueen III, of 200 h.p. This is a detuned Six H.C. with lowered compression ratio (5.25:1). This is the standard engine of the Dominie.

Of controllable-pitch versions developed from the original Gipsy Six I there are two, the Gipsy Six II, of 210 b.h.p. This corresponds to the Major II. In the Miles Mentor it is used as a fixed-pitch unit, and is called the Gipsyqueen I. In the Percival Proctor it is used as a constant-speed engine, is called the Gipsyqueen II, and is designed for leaded fuels.

Finally there is the new supercharged engine, the Gipsy Six III S., which develops 300 h.p. The bore and stroke have been increased to 120 mm. and 150 mm. respectively, and the compression ration is 6.2:1. For flight trials in the Airspeed Oxford this engine is known as the Gipsyqueen IV.

BOOK REVIEWS

"Model Gliders," by R. H. Waring. The Harborough Publishing Co., Ltd. 4s.

CLAIMING to be the first book of its kind devoted to this specialised phase of model aircraft construction, this contains a wealth of theoretical and practical information which should amply satisfy the most enthusiastic of modellers. It covers all phases of designing, building and flying model gliders and sailplanes from the smallest and most elementary gliders to the super-model sailplanes for serious competition work, ranging in span up to more than 7ft. It is copiously illustrated with sketches, diagrams, graphs and photographs, and runs to nearly 100 pages.

"Attack and Defence," by R. Horn. D. D. Jenkins and W. J. R. Price. Longmans. 1s. 6d.

WHILE this booklet has nothing to do with flying, as such, it will no doubt prove a useful textbook to members of the R.A.F. Regiment and others whose concern is the defence of airfields and the protection of aircraft on the ground. It tells, in 48 pages of pictures with explanatory captions, all the various ways of dealing with the individual aggressor, even when he is armed with revolver or rifle and bayonet, when one is unarmed oneself. The student of unarmed combat, it is clear, is not bound by Queensberry rules, and he must have no sort of "old school tie" compunction about kicking his adversary into insensibility when he has thrown him to the ground by one of the many methods so carefully described.

"Second Book of Aircraft Recognition," by R. A. Saville-Sneath. Penguin. 6d.

THE first book by this author, who is one of the accepted authorities on the subject, was restricted to about 60 types operating with the R.A.F. and the *Luftwaffe*. This second book not only deals with later types on which information has since become available, but includes a brief description of some of the most representative Italian machines.

As a supplementary volume, it does not repeat the elementary instruction contained in the first book, but the author, assuming the reader's knowledge of the structural classification used, has employed it again. Some helpful suggestions on individual and group training methods are also given and the 189 pages are generously illustrated with silhouettes, sketches and photographs.

COCKPIT CONTAMINATION

Keeping Exhaust Gases Out of Cabins and Compartments of Aircraft to Avoid Carbon Monoxide Poisoning

By D. C. GREENWOOD, A.M.Inst.B.E.

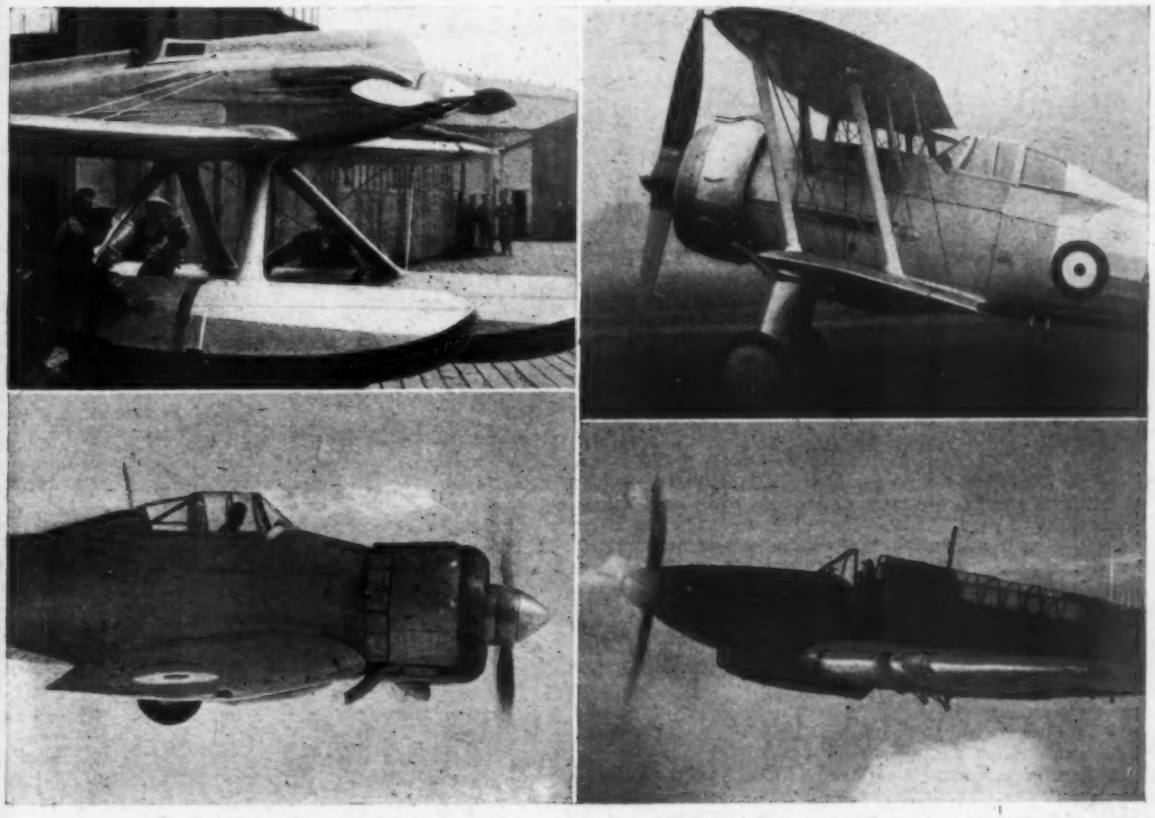
A DANGER which must be guarded against initially, if possible, in the design of an aircraft, or most certainly during its performance trials, is that of the contamination of the air in the cockpit with carbon monoxide present in the exhaust gases from the engine.

The gas is extremely poisonous, this being due to the fact that carbon monoxide combines with the red colouring matter (hæmoglobin) of the blood, forming a compound called carboxy hæmoglobin. The hæmoglobin is thus rendered incapable of carrying on its function as a distributor of oxygen to all parts of the body, and death results from a kind of suffocation if too much CO is present. It has been established that the maximum concentration of carbon monoxide at normal atmospheric pressure to which a person may be exposed without harm for one hour is 0.02 per cent. by volume at zero altitude and falls to 0.005 per cent. at about 15,000 feet. It is thus obvious that the efficiency of a fighter pilot—or for that matter, of course, any occupant of an aircraft—will be dangerously impaired if the gas is present.

Entry into the cockpit usually results either from an unforeseen condition of airflow or from a leak in the exhaust line when the exhaust from an engine is used to heat a cabin or compartment. The effects of the gas are very insidious and normally of gradual onset, so that warning is not given.

Taking Samples

During its performance trials tests for cockpit contamination are carried out by obtaining samples of the air inside the cockpit. The samples are obtained both during a ground run up of the engine and during flight. A rubber bladder is inflated with the cockpit air by means of a hand pump. These samples are then tested for CO concentration. A specially prepared test paper is treated with palladium chloride and then exposed to the sample of air obtained. This test paper gradually turns brown if CO is present. The time for it to change colour is noted, and the colour is then compared with standard colours. If the colour after about 90 minutes is a light brown, then the CO concentration is reasonably safe, i.e., below 0.005 per cent. If, however, it is a dark brown then it is unsafe.



SOME COCKPIT LAYOUTS : (Top left) The Supermarine S.5, built for the 1927 Schneider Contest, had a semi-enclosed cockpit. The main aim was to reduce drag to a minimum and some trouble was experienced with fumes. (Top right) The 260 m.p.h. of the Gladiator was the reason for this aircraft being the first military fighter to be enclosed. (Bottom left) The Gloster F7/30 monoplane fighter of 1934 was a good example of a standard layout with a radial engine. The pilot is seated high to get good visibility, and the exhaust is discharged below the cabin. (Bottom right) With ejector exhaust in line with the long cockpit, a certain amount of fuming did occur on the Fairey Fulmar if both cockpit covers were open. Being of good streamline shape there is negative pressure in the pilot's position and positive pressure in the rear cockpit. The exhaust fumes are sucked in at the back and travel forward to come out again at the front.

COCKPIT CONTAMINATION

FOUR MORE COCKPITS: (Top left) The Hurricane cockpit, like the rest of the machine, is essentially a utility job. It is an excellent compromise of low drag and visibility. Exhaust outlet is below the moving cockpit cover. (Top right) The N.A. Mustang layout gives good forward view, but a good deal of trouble has been experienced in ventilating the cockpit. (Bottom left) The unorthodox layout of the Airacobra has problems of its own. A door replaces the more usual sliding hood, and the shape and height of the roof are dictated by the airflow into the air intake. (Bottom right) The Spitfire cockpit is another utility compromise with a slight bias toward speed considerations. To keep the fuselage shallow, and at the same time provide good visibility for the pilot, the top engine cowling is almost flat.

The entry of the gas due to a leak in the exhaust line is not a very frequent cause of contamination. By far the most frequent source of trouble is that of the airflow in which the exhaust gases are mixed gaining access to the cockpit by being sucked in. The air inside the cockpit, and consequently any part of the aircraft which is not sealed, is often at a less pressure than the air outside. (This phenomenon is known as cockpit depression.) Thus, if the exhaust gases flow past any cracks or openings in the fuselage they will be liable to be sucked inside.

Trial and error methods must be adopted in order to cure the trouble by sealing any cracks or other places in which the gases may be gaining entry. Although with reasonable accuracy the source of entry can be deduced from an inspection of the aircraft. Single engine aircraft, with their engines directly in front of the cockpit, appear to be more prone to the trouble than aircraft having their engines situated on the wings; although these, also, can give trouble. Frequently the actual course of the exhaust gases can be traced for at least half of their track by means of the tell-tale blackened smoke trail which is left.

It would seem advisable, then, in the design of an aircraft, as far as practicable, to position the exhaust so that it will not, as far as can be judged, direct its gases past any openings in the fuselage or wings.

If this is not possible, then precautions should be taken to stop the entry either by sealing the initial entrance space or blocking the probable route of the fumes. This, however, can only be considered as a very generalised summary, for if an exhaust is in a position which appears bad from a CO point of view, it does not follow that contamination will actually be experienced. Unsuspected airflows, which cannot be forecast with any degree of accuracy, are the chief cause.

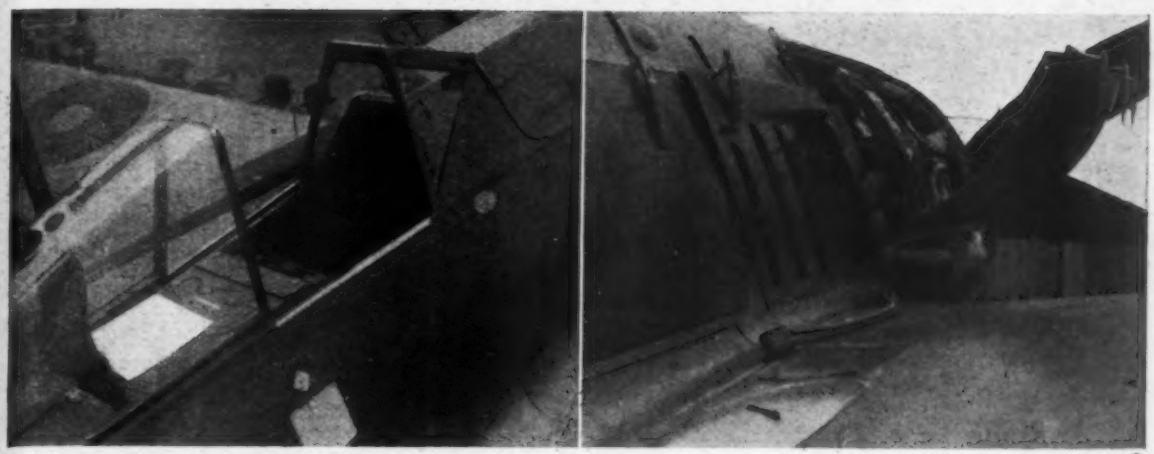
Oxygen, of course, to a great extent counteracts the effects of contamination, but even so it is still necessary, if CO is present, to use far more oxygen than would normally be required. In other words, if there was contamination, then oxygen would have to delivered at, say, 10,000ft. at a rate which would normally be required for, say, 20,000ft.

CO Indicators for Aircraft

In order that an automatic indication of the presence of carbon monoxide might be had, instruments have been designed to give visible indication of the concentration present. Audible warning can also be arranged to be given when the concentration reaches dangerously high proportions. These indicators may be installed either permanently or temporarily, say during the performance trials, as another means of testing for the gas.

The instrument consists essentially of:

(*a*) A means for continuous sampling of the air to be tested.
(*b*) A chemical for absorbing moisture.
(*c*) A cell in which carbon monoxide is converted into carbon dioxide.



GERMAN DECONTAMINATION : In the Focke-Wulf Fw 190 the cooling air is discharged from louvres aft of the exhaust stubs. This has the effect of keeping the exhaust gases slightly away from the fuselage and preventing them from penetrating the crevices of the sliding cockpit cover. It is of interest to note how far behind the pilot's head is the protecting slab of armour plate.

(*d*) An indicator of the rise in temperature of the cell. The indicator being graduated in terms of percentage of CO.

Air that is being tested flows continuously through the instrument by way of a canister containing a chemical drying agent, a flow indicator of capillary-tube type, a chemical cell, and a flow regulator. The instrument measures only 5¾in. × 5¾in. × 8in., and weighs 8 lb.

The heart of the instrument is the cell, which converts the carbon monoxide into carbon dioxide. It is composed of a granular mixture of manganese dioxide and copper oxide, which acts as a catalytic agent for the reaction. One end of the cell is charged with active and the other inactive chemical. A series of thermocouples embedded in the cells is used to measure the difference in temperature between the active and inactive sections of the cell. A millivoltmeter is utilised to measure the output of the thermocouples, the meter being graduated to indicate carbon monoxide content in the range of 0 per cent. to 0.15 per cent. Within the limit of accuracy of the method of analysis of the carbon monoxide-air mixture (iodine-pentoxide method, limit 0.003 per cent.) the e.m.f. developed by the cell is directly proportional to the carbon monoxide content of the sample of air being tested.

An indicator which gave audible warning by means of a buzzer alarm was installed in the United States' airship "Akron." In this instrument the output of the thermocouples went directly to a relay, the relay controlling the grid circuit of a radio valve.

The Late Wing Cdr. G. H. Stainforth, A.F.C.

WING CDR. GEORGE HEDLEY STAINFORTH, A.F.C., has been killed in action in the Middle East. He will always be remembered as the pilot who had three times held the world's high-speed record over a 3-kilometre course. He hailed from Sandhurst, not from Cranwell, and served in the Buffs from August, 1918, to 1922. Then he retired and joined the R.A.F. An exceptionally accomplished pilot, he combined skill, daring and caution in the right proportions. He was in the Schneider Trophy team in 1929 and 1931. In 1929 he was pilot of the Gloster-Napier, which was not selected for the race, but in it he put up a world's record speed of 336 m.p.h. In 1931, flying the Supermarine S6B, he created world records with speeds of 379.05 and later 407.5 m.p.h. He had been an instructor at the C.F.S. and a Farnborough test pilot. He was a most popular man among all who had the pleasure of knowing him personally.

The late Wing Cdr. G. H. Stainforth, A.F.C.

Seven Figure Veteran

CAPTAIN E. S. J. ALCOCK has completed his 2,000,000 miles in the air. Others of the flying staff of British Overseas Airways who have attained this recently are Captains O. P. Jones and F. Dudley Travers.

In command of the flying boat *Castor*, one of the four Empire flying boats which have now flown 1,000,000 miles, Captain Alcock stepped off at Durban recently, when it was announced that he had completed 16,674 flying hours, and had flown 2,000,000 miles. Captain Alcock is 41.

Celebrities Meet at Ferry Command Station

AN interesting meeting took place the other day on the tarmac of a Ferry Command terminal base in England.

First, an aircraft arrived from the United States. In it was Lt. Col. Elliot Roosevelt, son of the President of the U.S.

Ten seconds later, a Liberator arrived after a 3,000-mile flight from Montreal. From it alighted the Rt. Hon. Major Clement Attlee, Deputy Prime Minister, his Parliamentary Secretary, Mr. Arthur Jenkins, M.P., and Mr. Malcolm MacDonald, the British High Commissioner in Canada.

Twenty seconds later, a third aircraft, completing a shorter flight from another British airfield, brought Air Chief Marshal Sir Frederick Bowhill, Commander-in-Chief, Ferry Command, who has been in this country on a visit of inspection.

Then another aircraft flew in from Montreal. Its passengers included a Canadian Government mission, consisting of the Hon. C. D. Howe, Minister of Munitions and Supply; Colonel the Hon. J. L. Ralston, Minister of Defence; Mr. Ralph Bell, Director-General of Aircraft Production, and Mr. Desmond A. Clark, Director-General of Shipbuilding.

The party met on the airdrome apron, chatted together and had a glass of sherry and a sandwich before continuing their respective journeys. Soon, three aircraft were in the air again: Major Attlee and Mr. Malcolm MacDonald and the Canadian Ministers bound for London, Sir Frederick Bowhill in his Liberator away on his journey to Ferry Command headquarters at Montreal, and Lt. Col. Elliot Roosevelt to join the American Army Air Forces in Britain.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

BOMBING POLICY

Use of Fast Light Aircraft

THE news of Mosquitoes in action for the first time is of much interest. It points to a technique which was advocated earnestly by the opposers of big four-engined bombers—i.e., that of a very fast, comparatively small bomber which would compare favourably with any fighter, thus making it especially useful in daylight raids.

That the R.A.F. should adopt such a policy is pleasing, for the attacks of Mosquitoes, combined with those of American Fortresses, should enable us to increase greatly our daylight offensive against Germany and the Low Countries.

Similar to the Hawker Hart, which gave the fighters of that time a headache when it first appeared, the Mosquito looks like proving to be not "just another aircraft." "ASTRA."

INTERCHANGEABLE POWER PLANTS

Latitude Required in Cowling Fasteners

WHILE reading your excellent article on "Interchangeable Power Plants" in your September 24th issue, I found myself questioning your statement that "all engine cowlings are *interchangeable*, as they are made on jigs and checked on reference jigs," from which I presume is to be inferred that this method of production assists in the "saving of much valuable time in getting grounded aircraft back into the air again," a point which undoubtedly plays a very important part in operational work. Is this strictly correct?

Surely, to be classed as interchangeable, a part should be capable of being readily detached and replaced with its mating part. In spite of being jig drilled and checked on reference jigs, I wonder how far removable engine cowlings *are* actually interchangeable once a machine has been in flight.

From my experience, it would appear that there is considerable room for improvement in the method of fastening engine cowlings, and in my opinion a considerable amount of time and expense could be saved, both in production and maintenance, if more attention were paid to the type of fastener used in fixing these cowlings, in making certain that the fastener provided sufficient tolerance and latitude to allow for distortion which, I understand, often takes place after a flight.

It would be interesting to have readers' views on this small but, I suggest, important point. JOHN F. FLUDE.

FUEL CONSERVATION

The "Mating" Aspect of Running-in

AFTER reading your correspondent "Student" in *Flight* for September 24th, there are one or two points I should like to raise.

The running-in of an aircraft engine involves something more than "wearing off the tightness"; indeed with bearing clearances as they are at present, particularly in high powered engines, there is no "tightness" in the accepted sense of the word.

What is important is the gradual warming up of parts "mated" for the first time; of parts, such as pistons, which are shortly to be exposed to higher temperatures than hitherto in their "lives."

If a proceedure such as oulined by "Student" were to be adopted, i.e., "motoring over" by means of electricity, it would merely prolong the time the engine would have to be held on the test bed, as, after it was completed, it would still be necessary to run the engine under its own power, starting at low r.p.m., b.h.p. and temperature, and gradually increasing all three in exactly the same manner as that criticised.

Again, "Student" says: "Is it really necessary to continue to run an engine at more or less full throttle for hours on end, simply for running-in?" Here he is quite wrong. An aircraft engine is seldom, nowadays, run for hours on end during running-in. Neither is it "at more or less full throttle," as it only reaches cruising conditions, which is far from full throttle in the case of a supercharged engine, at the end of its running-in period.

It is, of course, possible to use electric dynamometers, but these are more expensive and delicate, and probably more difficult to obtain, than the faithful water brake.

"Student" has become a little confused when he says that "The engine could undergo its normal dynamometer tests and then the storage cells could be used . . . to drive the engine during its running-in period." Presumably he means drive the *next* engine during its running-in period.

There is one method, a time-honoured one, of running-in which "Student" has overlooked, i.e., by means of town gas. This has the advantage of simplicity, though of course, it uses fuel, albeit gas instead of petrol.

In any case "Student" may rest assured that every effort is being made to conserve precious high octane petrol, and to dispense with anything that tends to waste fuel or time.

M. C. GREY, A.R.Ae.S.

Allisons Tested with Airscrews

I WAS interested in the views of your correspondent "A. N. I." (*Flight*, September 10th) and the fact that electric regeneration is now a common practice in the U.S.A. Of that I was not aware. I gather, however, that my main point—advantages of hangar test bed over dynamometer for air-cooled engines (chiefly on the score of quick production) is accepted.

I should like to quote *verbatim* a passage from the July *Aircraft Engineering*, under the heading "Summary of Papers Read During the S.A.E. Conference, March 12th-13th, 1942," and sub-title, "Production Testing Facilities of Allison Division of General Motors."

"When Allison Division of General Motors entered the production field, the usual rush occurred to design and construct equipment and buildings. The ground rules then laid down, and rigidly adhered to since, specified that the greatest simplicity be maintained and little deviation could be made from known practice.

"The first decision reached pertained to the method of absorbing the power. Consideration was given to the use of electric dynamometer feeding back into power lines, to water brakes, to wooden test clubs and to controllable pitch airscrews.

"Controllable pitch airscrews were selected because it was felt that operating conditions would more closely approach those of flight. It was felt that dynamometer operation would not show up defects in that the engine would not be subjected to lateral movements and torsional vibration as in an aircraft. This was correctly proved by defects which appeared in engines tested with flight airscrews after a quantity had been production-tested on a dynamometer.

"Other factors entering into a decision against dynamometer equipment included the relative ease of obtaining airscrews instead of dynamometers; the ease of maintenance of airscrews and their record of long life in aircraft operation; the difficulty of designing or obtaining couplings that could be relied on for continuous use; the great quantities of cooling water required for electric eddy current absorption dynamometers or water brakes; and, finally, the ease and simplicity of installation and operation of the engine."

It would be interesting to know if the decision would have been the same had a shortage of electric power, tantamount to that existing in this country, been thrown into the balance. No doubt as the matter has been now raised in the House, the advocates of electric regeneration will have their chance in this country.

As to your correspondent's remarks on the average power of a test plant, I would point out that I referred to a period of "six hours on any busy production stand." This takes into account "hooking" and "unhooking" the motor(s). Also it refers to Final Test which, in the case considered, being the result of an investigation a few years back, included the tuning of a jet-type carburettor still used in large numbers to-day.

Although the regulations for aircraft engine testing issued by the Air Ministry apply to all types of engine, the routine to fulfil them may vary widely. For example, the use of carburettors which can be tuned on an air-flow rig will greatly cut down the running necessary on the test bed and will tend to make what running is done of a less spasmodic nature.

R. P. G. J.

Service Aviation

NIGHT INTRUDER: A Douglas Boston bomber running up its engines before going to occupied territory to bomb and shoot-up airfields, railway engines, power plants and other targets.

Royal Air Force and Fleet Air Arm News and Announcements

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards for bravery and resolution in H.M. Ships while escorting an important convoy to Malta:—

DISTINGUISHED SERVICE CROSS.

Sub.-Lt. (A) J. F. RANKIN, R.N.
Temp. Sub.-Lt. (A) L. P. TWISS, R.N.V.R.

DISTINGUISHED SERVICE MEDAL.

Ldg. Air Fitter A. P. DANIELS.

MENTION IN DESPATCHES.

Temp. Sub.-Lt. (A) P. E. PALMER, R.N.V.R.
Temp. Act. Sub.-Lt. (A) G. SPALDING, R.N.V.R.
Petty Officer Air Mech. R. WRIGHT.
Ldg. Air Mech. G. C. LUXTON.
Cpl. F. J. ROBSON, R.A.F.
Air Mech. (A) L. HENSHAW.
Air Mech. (E) J. SCOTT.

Royal Air Force

THE KING has been graciously pleased to approve the following awards, in recognition of gallantry and devotion to duty in the execution of air operations:—

DISTINGUISHED SERVICE ORDER.

Act. Grp. Capt. E. W. WHITLEY, D.F.C., R.A.F.O. - Grp. Capt. Whitley commanded a diversionary force comprising one Hurricane and one Blenheim Squadron, an armoured car unit, and other army units. From November, 1941, to January, 1942, he led his force with great determination. Although heavily attacked on occasions, and isolated as they were in the desert region between Jarabub and Jalo, his force did great execution on the Axis forces using the main road round the Gulf of Sinta, and in attacking airfields. Grp. Capt. Whitley planned all and led many of the operations. The number of enemy aircraft destroyed exceeded thirty. The excellent results achieved were, in a large measure, attributable to the leadership, steadiness and great courage of this officer. He has since commanded a wing with success.

Wing Cdr. G. R. HOWIE, No. 216 Sqn.—This officer has commanded the squadron for two years. He has played an active role in five separate campaigns: the Italian, Syrian, Iraqian, Greek, and the Western Desert, during which he flew some 1,200 hours (half of which were operational). During the Italian campaign he led many night bombing sorties as far as Benghazi. In the Greek campaign he led the squadron on communication duties. More than 100 sorties between Greece and Egypt were completed. During the evacuation the squadron, with Wing Cdr. Howie again to the fore, was instrumental in taking off 350 personnel.

In the Western Desert, in November, 1941, his squadron was engaged in ferrying petrol, ammunition and replacement pilots to advanced landing grounds, without fighter escort. During the siege of Tobruk he twice dropped wireless valves on the airfield, and, on a later occasion, transported special personnel there during enemy bombing raids and in face of heavy defending fire. Supplies were also dropped on two occasions when our troops were surrounded.

During these and other operations Wing Cdr. Howie displayed the highest qualities of leadership, efficiency and courage. Possessing great powers of organisation and displaying tireless energy, he has contributed in a large way to the successes achieved.

BAR TO DISTINGUISHED FLYING CROSS.

Act. Wing Cdr. J. BLACKBURN, D.F.C., R.A.F.O., No. 70 Sqn.—This officer as flight commander has displayed outstanding enthusiasm and keenness, which has proved a source of inspiration. Undeterred by enemy opposition he always presses home his attacks with the utmost skill and determination. Recently, over Benghazi, his aircraft was held in searchlight beams and subjected to accurate anti-aircraft fire. Despite this, he made another run over the area, and released his bombs alongside a ship moored in the outer Mole. On another occasion, in similar circumstances, at Martuba, Wing Cdr. Blackburn bombed the landing ground, starting three fires.

Sqn. Ldr. H. M. YOUNG, D.F.C., R.A.F.V.R., No. 104 Sqn.—This officer participated in the first large-scale attack on Naples, pressing home his attack, in the face of an intense barrage, with great determination. On another occasion he bombed the Castel Benito airfield, and then descended to 1,000 feet to machine-gun dispersed aircraft by the light of flares released by other attacking aircraft. At least two aircraft on the ground were set on fire and a gun emplacement silenced.

On a further occasion, when returning to Malta from a raid on Tripoli, a stick of bombs burst on the airdrome while Sqn. Ldr. Young was landing his aircraft, setting fire to a bomb-loaded aircraft. Displaying great coolness, he completed his landing and avoided obstructions on the runway. He dispersed his aircraft, then took charge of the flare path and had it moved so that the remainder of the squadron were enabled to land safely. This officer has always shown the greatest courage and determination both in the air and on the ground.

Group Capt. H. Broadhurst, D.S.O. and Bar, D.F.C., A.F.C., who has now been awarded a Bar to the D.F.C. for his share in the Dieppe raid. He flew alone in the raid area for a total of eight hours.

DISTINGUISHED FLYING CROSS.

Wing Cdr. A. F. JOHNSON, No. 203 Sqn.—This officer has commanded the squadron with conspicuous success during the past twelve months. He has displayed initiative and powers of leadership of a high order, never hesitating personally to undertake the more difficult operational tasks. The high standard of operational efficiency and keenness of his squadron is very largely attributable to his fine example and devotion to duty.

Act. Wing Cdr. E. TENNANT, No. 69 Sqn.—This officer has served in Malta for a year, formerly as a flight commander and latterly as a squadron commander. He has been one of the driving personalities of the squadron, which has performed admirable work in the face of great difficulties. Wing Cdr. Tennant has given great energy to assist maintenance personnel, and when enemy opposition has been slight he has directed available sorties to the training of his crews. Since December last, when the Germans returned to Sicily, reconnaissance work has been fraught with the greatest danger. During this period this officer has displayed great leadership. In almost every sortie he has either been attacked or pursued by enemy fighters. His example during this trying period has been exemplary.

Sqn. Ldr. P. G. D. FARR, No. 70 Sqn.—This officer has invariably displayed fearlessness and courage in the face of the enemy. On two occasions, over Benghazi, his aircraft has been hit by heavy anti-aircraft fire, but this did not deter him from bombing the target. On another occasion, in an attack on the landing ground at Derna, he courageously pressed home his attack in the face of considerable anti-aircraft fire, releasing his bombs amongst dispersed aircraft. A large fire

was started followed by explosions. This officer has always displayed unfailing devotion to duty, whilst his professional knowledge has done much to maintain the efficiency of his flight.

Sqn. Ldr. D. L. GOULD, No. 33 Sqn.—This officer completed 240 hours operational flying in France and England (during which period two enemy aircraft were destroyed by his gunner) before proceeding to the Middle East. In the Western Desert he has destroyed three Me.109s, probably destroyed five other enemy aircraft, and damaged a further four. During the earlier part of the Libyan campaign his squadron was extensively employed on ground machine-gunning attacks. It was responsible for the destruction of 750 mechanised vehicles, 50 of these being destroyed by Sqn. Ldr. Gould. His leadership and personal example have played a large part in the high morale and success of his squadron.

Sqn. Ldr. W. A. GRIFFITHS, R.A.F.V.R.—Sqn. Ldr. Griffiths completed many operations over France and Germany before being posted to the Middle East. He has completed many hazardous operations.

Sqn. Ldr. I. B. WESTMACOTT.—This officer fought in the Battle of Britain, in which he destroyed three and damaged another three enemy aircraft. Subsequently he participated in fighter sweeps over France. In March, 1941, he was posted to Malta, where he has destroyed one enemy fighter and damaged a He.111. Early in December, 1941, Sqn. Ldr. Westmacott was appointed to command a night fighter flight, and has participated in a number of "intruder" sorties. Although on two occasions this officer's aircraft has been shot down, and he has been compelled to escape by parachute, he has at all times displayed great keenness to get to grips with the enemy.

Act. Maj. J. A. WILLIAMS, S.A.A.F., No. 24 (S.A.A.F.) Sqn.—Since the squadron first went into action this officer has completed numerous bombing raids. In May, 1941, whilst flying a Maryland aircraft on a long-range fighter escort to H.M. ships south of Crete, he engaged a Me.110 with his front guns and shot it down into the sea. In December, 1941, his aircraft was one of a small formation of Bostons which were attacked by 16 Me.109s. His aircraft was shot down, but Maj. Williams and two of his crew escaped by parachute. Although he was slightly wounded, he remained on operations. He has led very successful raids on the enemy.

Act. Sqn. Ldr. M. T. JUDD, A.F.C., R.A.F.V.R., No. 250 Sqn.—This officer has led his squadron on every one of its sorties in the latest battle for Libya, including many long-range machine-gun attacks on enemy mechanised transport in the Jebel area. He has taken part in escorts to Boston bombers raiding Benghazi and Tobruk when the battle was out of range of the ordinary fighters; he also took part in the successful machine-gunning of Gazala airdrome. On May 12th the squadron intercepted a force of Ju.52s escorted by Me.110s between Derna and Matime. In the ensuing engagement 13 Ju.52s and two Me.110s were shot down; Sqn. Ldr. Judd destroyed two of the Ju.52s himself. By his courage and devotion to duty he has contributed materially to the high standard of morale and fighting efficiency of his pilots.

Act. Sqn. Ldr. K. A. LAWRENCE, No. 185 Sqn.—This officer led his flight, and subsequently the squadron, for more than four months. Throughout, he displayed great courage and outstanding keenness. His example at all times, especially when the odds were great, was of the best. He has destroyed four, probably destroyed and damaged many other enemy aircraft.

Rear Admiral Morgan and Air Comdre. W. A. Bowen-Buscarlett at the ceremony of the presentation of the George Cross to Malta.

SERVICE AVIATION

Act. Sqn. Ldr. W. C. WIGMORE, No. 235 Sqn.—Sqn. Ldr. Wigmore is an outstanding leader. One morning in June he escorted convoys to Malta from east of Cape Bon and nea. Pantelleria respectively, when there was much enemy fighter activity in those areas. Despite this, he attacked and shot down one fighter and damaged a Ju.88 which were attacking the convoy. He has led his section in fighter cover on all "Beaufort" sorties against the Italian fleet and against convoys to the west and east of Malta.

Flt. Lt. H. N. BLUNDELL, R.N.Z.A.F., No. 104 Sqn.—This officer is engaged on his second operational tour. Before proceeding to the Middle East, he took part in sorties over Germany and France, including targets at such highly defended places as Kiel, Cologne, Hamburg, and many others. In the Middle East, his sorties have included the submarine base at Salamis and the airfields of Crete, both during the evacuation and since; he has also made many attacks on objectives at Benghazi. He has attacked objectives at Naples, Taranto, Cagliari and Messina. Flt. Lt. Blundell is the squadron navigation officer and bombing leader. He takes immense pains in the training of new observers and in the organisation of the bombing.

Flt. Lt. M. S. BLYTH, No. 37 Sqn.—This officer has participated in attacks on objectives in occupied France, Germany, Crete, Cyrenaica, Tripolitania, Sicily, and the Dodecanese. Throughout he has proved himself to be a most skilful and courageous pilot and could always be relied upon to complete his allotted task with determination.

Flt. Lt. G. McL. HAYTON.—Flt. Lt. Hayton is an outstanding and fearless night fighter pilot. Since his arrival at Malta he has destroyed four, probably destroyed two, and damaged two enemy aircraft. On the night of May 22nd he destroyed one B.R.20 and probably destroyed another during the same sortie.

Flt. Lt. G. L. MACINTYRE, No. 221 Sqn.—This officer is a captain of outstanding courage and ability. He has been engaged on operations almost continuously since the war began, and has always shown enthusiasm. He has completed many hours' operational flying, involving patrols over the North Sea and the Atlantic, from England, Northern Ireland, and Iceland. On two occasions he has succeeded in locating and attacking enemy submarines.

Flt. Lt. J. G. MANFORD, R.A.A.F., No. 203 Sqn.—In January, 1942, this officer was engaged on a routine patrol from Benghazi and intercepted a submarine which was bombed and probably damaged. Immediately afterwards, the enemy battle fleet was observed. On this, his first operational flight with this unit, Flt. Lt. Manford proved himself to be an able reconnaissance pilot. In March, 1942, he was detailed to intercept and shadow enemy warships. Although he was new to the type of aircraft and had never flown it at night, he unhesitatingly undertook the duty, which involved a flight over the sea of nearly four hours at night and a landing in the dark.

Flt. Lt. R. V. MUSPRATT, No. 140 Sqn.—This officer has carried out day and night bombing sorties. Flt. Lt. Muspratt has at all times displayed great determination. Undeterred by enemy opposition, he has invariably obtained exceptional results. This officer is a first-class flight commander. He never hesitates to undertake a difficult operational task himself rather than detail an inexperienced pilot.

Capt. J. P. BLAAUW, S.A.A.F., No. 40 Sqn.—This officer has always displayed the greatest loyalty and devotion to duty. By his own splendid example he has maintained the morale and confidence of his pilots by personally undertaking most of the more dangerous sorties.

Capt. L. C. BOTHA, S.A.A.F., No. 5 Sqn (since reported missing).—On June 3rd, 1942, Capt. Botha was the pilot of one of a formation of nine aircraft which intercepted an enemy force of some 12 Ju.87s escorted by over 20 fighters. Disregarding the fighters, Capt. Botha dived down to attack the bombers. Pressing home his attacks with the utmost determination, courage and skill, and in spite of attacks by the enemy fighters, he remained in combat until he had expended all his ammunition and had destroyed three of the Ju.87s and assisted in the destruction of another.

Capt. W. A. NEL, S.A.A.F., No. 40 Sqn.—This officer performed exceptional service in East Africa. In the Western Desert, especially within the last few weeks, his personal courage and leadership have been outstanding. On one occasion Captain Nel outfought six Me. 109s and flew safely to base, returning with invaluable information.

Act. Flt. Lt. I. J. BADGER, No. 73 Sqn.—This officer has been engaged on operational flying for a long time. He took part in the air fighting in France in May, 1940, and on his return to this country he fought in the Battle of Britain. Posted to the Middle East, his exceptional qualities under extremely hazardous conditions have been outstanding. On 20th March, 1942, Flt. Lt. Badger participated in a machine gunning attack on the airfield at Derna. He displayed coolness and clever anticipation in the combined effort of the formation, which resulted in the destruction of several enemy aircraft on the ground and the complete destruction of an illuminated flare path.

In May, in a special sortie of three aircraft, operating from the most advanced operational landing ground, Flt. Lt. Badger was again to the fore. Although the success of this sortie depended on accurate flying, governed as it was by the limitation of fuel capacity, he successfully reached the target and machine gunned dispersed aircraft near the hangars. Flt. Lt. Badger flew his aircraft safely back to base. This officer has destroyed three, probably destroyed four and damaged six other hostile aircraft.

Act. Flt. Lt. G. T. CHINCHEN, R.A.A.F., No. 3 (R.A.A.F.) Sqn. (since reported missing).—This officer has shown outstanding courage and devotion to duty. Although he has been shot down and, on numerous occasions, had his aircraft severely damaged, it has in no way diminished his keenness or fighting spirit. During the fighting from May 26th to June 1st, 1942, he led numerous formations in dive-bombing and machine gun attacks on important enemy concentrations, always pressing home these attacks with great determination and courage, inflicting considerable damage on equipment and troops. His steadiness and sound leadership have proved a big factor in the success of his formations on these and many other operations such as fighter sweeps, bomber escorts and Army co-operation work in earlier phases of the Western Desert campaign.

Act. Flt. Lt. A. E. GLAZER, R.C.A.F.—In the course of a large number of sorties this officer has performed excellent work as observer, the majority of them have been executed at night in all kinds of weather. He was instrumental in the destruction of an enemy vessel of some 10,000 tons off the coast of Sicily. Again, on the night of December 12th, 1941, he participated in an operation which resulted in the destruction by H.M. ships of two Italian cruisers off the North African coast.

Act. Flt. Lt. N. W. LEE, R.A.F.V.R., No. 249 Sqn.—This officer has been engaged in active operations over Malta for 3½ months, most of which were during the period of heavy air attacks, when the numbers of our own aircraft were few, and every operation entailed fighting against great odds. He has destroyed three enemy aircraft and damaged several more. Flt. Lt. Lee has on all occasions led his flight with great gallantry.

Act. Flt. Lt. F. MASON, No. 80 Sqn.—This officer joined the squadron in June, 1941, as an airman pilot. He has always shown great keenness, and has led sections and flights with great determination. He has participated in at least 12 escorts to bomber aircraft, and he has destroyed at least three enemy aircraft.

Act. Flt. Lt. G. H. WESTLAKE, R.A.F.V.R., No. 213 Sqn.—Flt. Lt. Westlake is a daring and tenacious fighter pilot. As a flight commander he has proved a great success. On the occasion when he has led the squadron he has shown brilliant resource coupled with a high degree of accuracy. He has destroyed at least eight enemy aircraft.

Act. Flt. Lt. A. C. WOODLEY, R.A.F.V.R., No. 148 Sqn.—Before joining this squadron this officer completed 27 operations, including attacks on such highly defended targets as Berlin, Mannheim, Hamburg and other important places in Germany and German-occupied territory, and on the Channel ports. In the Middle East he has acted as rear gunner on many occasions against targets in Cyrenaica and Crete, and from Malta against Comiso. No duty has ever been too arduous. For the past few months he has been employed as squadron leader. By his zeal, skill and personality he has established a high standard of air gunnery in the squadron. He still insists on flying with new crews as rear gunner on their first operational mission.

Act. Flt. Lt. L. T. SPENCE, R.A.A.F., No. 3 (R.A.A.F.) Sqn.—During a period of fighting in the Western Desert, when the squadron was engaged on dive-bombing and ground machine gunning operations, he led numerous formations in raids on important enemy concentrations, and always pressed home his attacks with great determination and courage. Considerable damage was inflicted. His steadiness and sound leadership were a big factor in the success achieved by his formation on these operations and also when engaged on bomber escort and army co-operation duties in the Western Desert campaign. Flt. Lt. Spence has destroyed two enemy aircraft.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. D. BARNETT, R.A.F.V.R., No. 230 Sqn.—As first wireless operator on Sunderland aircraft, this airman has seen service in Great Britain, Egypt, Malta, Gibraltar, Greece, Crete, Iraq and Cyrenaica. He has taken part in two successful sea rescues. On three occasions, when under enemy fire, his coolness in passing messages was outstanding. In the last engagement his aircraft was shot down, but Flt. Sgt. Barnett continued to transmit messages to base until the aircraft began to break up on the rugged coast.

Flt. Sgt. A. C. BENNETT, No. 104, Sqn.—Besides participating in operations in the Middle East, this airman has completed sorties over Germany while the squadron was based in this country. On one occasion over Cologne, the aircraft, in which he was acting as second pilot, was severely damaged by fire from an enemy fighter. Although he sustained a bullet wound, Flt. Sgt. Bennett rendered every assistance to his captain on the return flight. His conduct lent much confidence to the other members of the crew. On his first sortie after becoming a captain he made a skilful landing at a strange airfield after one engine of his aircraft had burst into flames. Once, whilst over Berlin, one engine of his bomber was put out of action by shell-fire. Despite this he flew on and bombed his objective. The return flight from Berlin to this country was accomplished nearly the whole way on one engine. On another occasion he displayed commendable skill and courage when bombing Benghazi from a low level.

Flt. Sgt. (now W/O.) W. C. BRODIE, No. 38 Sqn.—Flt Sgt. Brodie is an exceptional pilot who carries out his operations with courage and deter-

SERVICE AVIATION

mination and has carried out difficult operations with outstanding success.

Flt. Sgt. R. V. C. DANGAR, R.A.A.F., No. 450 (R.A.A.F.) Sqn.—This airman has carried out his work with unabated zeal and courage during the present campaign. He has been a consistent cover leader and has carried out numerous reconnaissances, the results of which have proved of great value to both the R.A.F. and the Army.

Flt. Sgt. (now W/O.) W. H. GRAY, R.N.Z.A.F., No. 108 Sqn.—Flt. Sgt. Gray is an exceptionally fine captain. His sorties have been completed with determination and good results have always been achieved. On one occasion his aircraft was badly damaged by anti-aircraft fire over Benghazi. Despite this, he skilfully flew back to base and made a safe landing.

Flt. Sgt. E. LEWIS, No. 230 Sqn.—This airman is employed as rear gunner and wireless operator of a Sunderland aircraft. The successful conclusion of many valuable reconnaissances and anti-submarine operations can be attributed to his high standard of marksmanship. Flt. Sgt. Lewis served with distinction during the evacuation of Yugoslavia, Greece and Crete. He has recently participated in several attacks on hostile submarines.

Flt. Sgt. W. G. MCGHEE, No. 230 Sqn.—A most capable wireless operator, this airman has also specialised in turret gunnery. His shooting has been of a high order, while his observation has been so efficient that his pilots have always been warned in ample time to evade enemy aircraft. A total of 35 have been observed during his patrols. Flt. Sgt. McGhee has taken part in attacks on enemy submarines, his accurate shooting being of great assistance. He helped in the rescue of a Swordfish crew off Sicily and a Fulmar crew from the "Ark Royal" who were afloat in the Western Mediterranean. On three occasions, whilst his aircraft was on the water, he stood by his guns to ward off enemy bombing attacks. On another occasion, his aircraft was set on fire and it sank. Although a poor swimmer Flt. Sgt. McGhee was able to reach the shore unaided.

Flt. Sgt. B. M. THOMPSON, R.A.A.F., No. 3 (R.A.A.F.) Sqn.—Throughout his sorties, this airman has displayed great courage and devotion to duty He has on numerous occasions returned from fighter patrols with valuable and accurate information of the disposition and movement of ground forces. During the fighting from May 26th to June 1st, 1942, Flt. Sgt. Thompson participated in numerous dive-bombing and machine gun attacks on important enemy concentrations. He always pressed home his attacks with vigour, inflicting considerable damage on equipment and troops. Each time he returned with valuable information regarding enemy movements, which proved of great importance to the Army. Flt. Sgt. Thompson has destroyed at least two enemy aircraft.

Roll of Honour

Casualty Communiqué No. 160.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

KILLED IN ACTION.—Sgt. R. H. Armstrong; Sgt. O. C. C. Barnes; F/O. M. G. Degzon; Sgt. E. Bridge; Sgt. N. S. Comber; Sgt. W. C. Garland; Sgt. L. G. Harris; Sgt. D. F. Hubbard; Sgt. F. R. E. McCarthy; P/O. S. A. Spencer; Sgt. H. Taylor; Sgt. P. G. Teall; Sgt. E. Webster.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. K. T. Barker; Flt. Sgt. C. T. T. Brady; P/O. A. Downie; Sgt J. J. G. Hall; Sgt. T. Strang; Sgt. P. F. V. Winkle.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. W. Anderton; Sgt. D. T. Brett; Sgt. L. R. Brockett; Sgt. H. Carter; Sgt. W. A. Hughes-Hughes; P/O. D. C. Hunter; P/O. C. L. Jenkins; Sgt. R. B. Kinnell; Sgt. F. G. Kipps Sgt. B. W. Robbens, Sgt. D. H. Roberts; F/O. B. M. Sayers; Sgt. A. V. W. Sherwin; Sgt. R. N. Whalley.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. C. J. Foote.

WOUNDED OR INJURED IN ACTION.—P/O. E. D. Taylor.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. H. Breuer.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. S. Fox; P/O. D. H. Johnson.

MISSING.—Sgt. N. Acton; Sgt. G. Alder; Sgt. T. G. R. Allaway; Sgt. W. J. Atchison; Sgt. W. B. Barr; P/O. P. H. Basson; P/O. G. C. Bayley, D.F.C.; Sgt. S. F. O. Blackmore; Sgt. G. Blatherwick; Sgt. E. H. Boumphrey; Sgt. C. W. Bourke; Sgt. A. R. Bowen; Sgt. R. I. Bowen; F/O. A. J. L. Bowes; Flt. Sgt. A. R. Bray; Sgt. J. A. Brogan; Sgt. R. Brooke; P/O. H. E. Brown; F/O. J. G. Brown; Sgt. R. H. Burley; Sgt. A. F. C. Card; Sgt. W. K. Daniel; Sgt. A. H. Davies; Sgt. E. H. Dean; Sgt. P. J. Dillon; Sgt. L. G. Dowling; Sgt. D. R. C. Drake; Sgt. L. D. Firminger; Sgt. H. J. Ford; Sgt. R. Forgie; Flt. Sgt. E. C. Glenwright; Sgt. J. L. Graham; Sgt. T. Greggs; Flt. Lt. The Hon J. A. H. Greville Sgt. C. J. Griffiths; Sgt. A. E. Hall; W/O. W. Harrison; Sgt. E. Hayllis; P/O. J. L. Hicks; P/O. P. W. Hoad; Sgt. E. A. Holland; P/O. D. A. Holliger; Sgt D. Horgan; Sgt. J. E. Howell; Flt. Sgt G. A. L. Hunter; Sgt. F. W. Huntley; Sgt F. C. Isted Sgt. D. S. James; Sgt. D G. Jillings; Flt. Sgt. M. G Johnson; Sgt. T. A. Jones; P/O. T. W. Kenyon; Sgt. J. A. Kilner; Sgt. D. S Large; Sgt. H. G. Lawrence; Sgt. L. A. Lister; P/O. A. F. Litzow; Sgt. G. W. J. Lovell; P/O. V. Lowson; P/O. H. C. McComas; Flt. Sgt. F. W. Martin; Flt. Sgt. J. Martin; Sgt. W. Matheson; P/O. T. K. Matthews; P/O. C. Mitchener; Flt. Sgt. E. B. Moorhouse; Sgt. G. C. Morffew; Sgt. J. Morgan; Sgt. J. W. Morgan; Sgt. D. Morris Sgt. J. Munro; Sgt. D. S. Murphy; P/O. J. W. Naden; Sgt. H. G. Le B. R. Pakenham Walsh; Sgt. C. S. Parker; P/O. H. Pearce; Sgt. W. F. V. Pink; Flt. Sgt. D. J. Popple; Sgt. D. A. Redler; Sgt. J. R. Rennie; P/O. G. Richards; Sqn. Ldr. W. Riley, D.F.C.; P/O. D. Rogers; Sgt. W. H. Rogers; Sgt. H. Ross; Sgt. G. A. Russell; P/O. J. W. Scott; Sgt. R. H. C. Seymour; Sgt. B. A. Shepherd; Sgt. F. H. G. Simkins; P/O. H. J. Skelly; P/O. J. B. Skrender; Sgt. P. H. Smith; Sgt. R. J. Smith; P/O. L. S. Stewart; Sgt. P. K. J. Street; P/O. E. W Swatton; P/O. W. J. Taylor; Sgt. E. A. Thomas; Sqn. Ldr. J. St. J. Thompson; Sgt. F. C. Thorogood; Sgt. L. D .Trayien; Sgt. E. A. Tweedale; Flt. Lt. R. A. Upshur; Sgt. T. Wakefield; Sgt. M. E. Warburton; Sgt. A. E. Watkins; Sgt. C. S. Weston; Sgt. D. J. B. White; Sgt. B. Whitham; Sgt. A. Whittaker; Sgt. R. Wilde; P/O. D. P. Williams; Sgt. S. J. Wilson; Sgt. J. A. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Act. W/O. W. C. Pitman; Cpl. H. Wright.

KILLED ON ACTIVE SERVICE.—Sgt. A. F. Bell; Sgt. W. H. C. Booth; L.A/C. B. T. Bowden; Sgt. K. Castleton; Flt. Sgt. G. T. Chapman; Sgt. D. C. Cochrane; P/O. B. P. Dehaven; Sgt. D. W. Dowling; Cpl. C. G. Easey; Sgt. F. T. Ellingham; P/O. R. A. Flood; P/O. A. S. Hall; P/O. B. E. Hawes; Sgt. I. Hughes; L.A/C. D. H. J. James; P/O. T. H. Jones; Sgt. W. A. Kup; Sgt. W. H. Lacey; Sgt. W. McL. Lomax; A/C.2 L. D. Neville; Sgt. W. S. Priest; Flt. Lt. J. K. Rhodes; Flt. Sgt. S. N. Ryder; Sgt. S. Simpson; Sgt. E. A. Smith; Sgt. W. Smith; Sgt. S. W. Stockford; Sgt. L. J. Storey; Sgt. E. Thorley; Sgt. B. Williams; Sgt. D. A. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. B. D. Waghorn.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 A. L. A. Aikman; A/C.1 C. W. Barnes; Sgt. N. C. Blackband; A/C.1 W. E. Colbourne; A/C.2 G. A. Robinson; P/O. E. Saville; A/C.2 P. G. Thorne; L.A/C. F. F. Wade.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 L. H. Breknell.

DIED ON ACTIVE SERVICE.—A/C.1 M. A. Baxendale; Sgt. S. Jackson; Cpl. G. A. McKie; L.A/C. W. M. A. Palmer; A/C.1 A. E. Tyler.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 A. M. Bunting; A/CW.1 M. H. Ladner.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. J. D. Sandilands; Sgt. A. L. Strang; Sgt. W. R. Wren.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. C. Weeks.

MISSING.—Sgt. P. P. Adams; Sgt. J. A. Alcorn; Sgt. R. T. Bannister; Flt. Sgt. A. W. Johnson; Sgt. E. H. Longbottom; Sgt. J. K. Paton; Sgt. B. W. Richards; Sgt. J. M. Squire; Sgt. N. White.

KILLED ON ACTIVE SERVICE.—Sgt. J. L. Anderson; Sgt. W. J. Birmingham; Sgt. R. E. Richards.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. G. A. Price; P/O. J. A. St. Oura.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. C. A. Eastwood.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. N. A. Payne.

MISSING.—Sgt. M. A. Bennetto; Sgt. G. A. R. Bissonnette; Sgt. G. V. C. Booth; D. O. Felt; Flt. Sgt. E. Fortin; Sgt. J. W. Ganes; Flt. Sgt. W. McI. McLachlan; Sgt. H. D. Peters; Sgt. N. McI. Rattray; Flt. Sgt. D. P. Roberts.

KILLED ON ACTIVE SERVICE.—Sgt. F. L. J. Hartnett; Sgt. J. M. Kennedy; Sgt. A. F. Pearson; Act. Sqn. Ldr. L. B. B. Price.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. R. J. Stubbings.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. A. O'Brien; Sgt. W. B. Stehr.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. M. Y. Kennedy.

MISSING.—Sgt. T. H. Cray; Sgt. G. McD. Frostick; Sgt. H. E. Godfrey; Sgt. E. W. B. Howard; Sgt. N. R. Kilpatrick; P/O. L. M. Mason; Sgt. K. S. Spencer; Sgt. C. E. Wells.

Casualty Communiqué No. 161

Royal Air Force

KILLED IN ACTION.—Sgt. J. G. Daniels; Sgt. F. G. Ellis; Sgt. H. D. Ovenstone; Sgt. M. H. Thompson; Flt. Lt. R. E. B. White.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. B. Allan; Sgt. J. Cox; Sgt. W. J. Cuming; Flt. Sgt. L. F. R. Davis; Sgt. P. H. Foster; Sgt. A. G. Harvey; Sgt. E. W. Jackson; Sgt. M. D. Jones; Sgt. H. B. Lee; Sgt. B. J. McGinn; P/O. E. G. Marker; Sgt. W. G. Marsh; Sgt. J. H. Piley, D.F.M.; Sgt. E. Rose; P/O. H. A. Schumm; Sgt. R. M. Sutton; Sgt. R. Tollett; L.A/C. A. P. Walker; P/O A Wilkinson; Sgt. G. H Willis.

General O'D. Hunter pinning the U.S.A.A.F. "wings" on Major Daymond, D.F.C. and Bar, during the ceremony of handing over the Eagle Squadrons from the R.A.F. to the United States Army Air Force.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. F. Aldous; Sgt. R. Allan; Sgt. T. E. Anstey; Sgt. A. S. Austin; P/O. R. A. Baseby; Sgt. W. B. Billingsley-Dooley; Sgt. C. T. Black; Sgt. L. A. Churcher; P/O. P. T. Close; P/O. E. D. Comber-Higgs; Sgt. G. C. Davies; Sgt. R. B. H. Driver; Sgt. B. A. Dungey; Sgt. D. S. Edmond; Sgt. G. A. Gale; Sgt. A. H. Gardener; Sgt. G. A. Glanville; Sgt. E. J. F. Grant; Sgt. S. D. Gummery; P/O. H. G. Harris; Sgt. J. G. Henderson; Sgt. E. Hill; Sgt. F. Hinton; P/O. D. A. Howard, D.F.M.; P/O. L. M. Jacob; P/O. T. F. Jacobs; Sgt. S. H. James; P/O. T. L. Kaschula; Sgt. J. O. M. Lobo; Sgt. D. M. Macfarlane; Flt. Sgt. K. McKenzie, D.F.M.; P/O. J. B. Macleod; Sqn. Ldr. T. I. Mathewson; Act. Flt. Lt. B. Parnell; Sgt. P. C. Petterson; Act. Flt. Lt. T. F. Priest; Sgt. J. H. M. Pulford; Sgt. O. E. Rance; P/O. G. W. Ratlidge; P/O. E. D. Rawes; Sgt. W. B. Robertson; Sgt. E. J. Snelling; Act. Flt. Lt. R. H. Strang; F/O. F. W. O. Street-Porter; Sgt. E. Wade; Sgt. J. Warren; Sgt. R. I. Watts; Sgt. A. Whewell; Sgt. J. Wild; Sgt. J. A. Willis; Sgt. J. W. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. J. G. Brown; Sgt. J. G. Fogarty; F/O. H. C. Pearce.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. H. Abbott; Flt. Sgt. L. Battersby; Sgt. A. C. S. Clive-Davies; F/O. W. L. Cox; Cpl. P. R. Field; Sgt. F. H. W. Gurnett; Sgt. D. Kenyon; Sgt. W. J. Mansbridge; Sgt. G. F. Muir; Sgt. C. Pottas; Sgt. L. V. Schafer; Sgt. S. E. Smith; P/O. A. A. Webster.

MISSING.—Sgt. A. Aldridge; Sgt. R. E. E. Bedford; Flt. Sgt. A. H. Bolus; Sgt. C. A. Bowes; P/O. J. N. Brady; Sgt. E. J. Buckton; Sgt. E. G. P. Capham; Sgt. B. E. Coffey; Sqn. Ldr. L. R. Cohen; P/O. R. H. Curran; Sgt. J. C. Drennan; Sgt. L. E. Evans; Sgt. R. H. Foster; Sgt. J. A. E. Hann; P/O. C. Harkness; P/O T. M. F. Hulse; P/O. H. J. Ivory; Sgt. A. James; W/O. P. O. Jones, D.F.M.; Sgt. R. B. Kendall; Sgt. G. E. Lee; Sgt. K. McLennan; Sgt. G. Martins; Sgt. J. H. Miller; Sgt. A. W. Newhouse; Sgt. K. M. Nichols; Sgt. H. A. Oates; Sgt. J. R Pendlebury; Flt. Sgt. C. H. Ship; W/O. G. E. Shone; P/O. V. M. Smith; Sgt. R. F. Stainforth; Flt. Sgt. P. H. H. Thirkell, D.F.M.; Sgt. D. J. Ware; Sgt. J. G. Watson; Flt. Lt. D. W. Whiteman; Sgt. J. F. Whittaker; Sgt. W. J. Wilkinson; Sgt. A. D. York.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. Adderly, D.F.M.; Sgt. W. J. Bagley; L.A/C. K. J. Barltrop; Sgt. H. E. Barton; Sgt. J. W. Bode; A/C.1 W. S. Boyce; Flt. Sgt. J. G Y. Boyle; A/C.2 J. Bradley; A/C.1 J. Capp; F/O. M. A. Coote; Cpl. E. L. Coverdale; L.A/C. J. Craig; Sgt. D. W. Davies; Sgt. T. W. Dinsdale; Sgt. A. E. Finney; Sgt. O. D. Hancock; Sgt. C. Hayton; Sgt. J. A. Henson; Act. Sgt. R. S. Holden; L.A/C.

SERVICE AVIATION

A. W. Hughes; P/O. E. S. Jenner; Sgt. L. J. Langan; Sgt. S. Lightowler; Sgt. T. L. McDonald; Act. Sgt. S. L. Mason; Sgt. C. H. Morgan; Cpl. R. C. Morris; Sgt. J. Munro; F/O. T. A. Newton; L.A/C. J. L. W. Pearson; P/O. A. Simons; Cpl. G. W. Virgo; Sgt. A. Wareham; P/O. G. P. D. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. C. Dunn; Flt. Sgt. E. G. Forster; Flt. Sgt. J. L. Roberts; W/O. F. G. E. Tizard, D.F.M.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. C. J. S. Buckle.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. C. G. Mead; L.A/C. C. A. Mortimer; P/O. J. C. Morton; Sgt. F. W. Pinkerton; A/C.1 A. Sloan; L.A/C. J. Thomas; L.A/C. V. B. M. Thomas; Cpl. L. Turrell.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. A. Baylis; P/O. B. C. Cosham; Sgt. A. R. Merritt.

DIED ON ACTIVE SERVICE.—Cpl. L. H. Atkinson; A/C.1 R. Barron; A/C.2 V. Bodenham; A/C.1 W. B. Downing; A/C.2 F. G. Giannasi; A/C.2 T. Horne; A/C.1 R. J. Miles.

Royal Australian Air Force

KILLED IN ACTION.—P/O. R. Clark.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. B. J. Adam; Sgt. W. J. Dillon; Sgt. R. W. Fisher; Sgt. W. W. Forgan; Sgt. G. M. Hart; P/O. B. P. Hickey; Sgt. V. W. Johnstone; Sgt. C. W. L. Pooley; P/O. J. W. Roche; Sgt. M. A. Sullivan; Sgt. P. C. Voller.

MISSING.—Sgt. A. H. C. Bates; Sgt. J. Boylè; Sgt. J. N. Dean; Sgt. C. D. Kennedy; Sgt. J. M. Lefrey; Sgt. F. L. McIntyre; P/O. R. S. Spear; Sgt. C. J. Stallard; Sgt. A. Wyles.

KILLED ON ACTIVE SERVICE.—Sgt. H. L. Devlin.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. W. R. Scott.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. F. B. Grundy; Sgt. J. M. Thompson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Cormack; P/O. A. J. Fraser; Sgt. D. L. Henderson; Sgt. W. S. Tyler.

MISSING.—Sgt. P. B. Andrews; Sgt. K. J. Aronson; Sgt A. F. Conway; P/O. G. V. Desourdy; P/O. M Edwards; Sgt. R. E. Fahey; Flt. Sgt. L. Foster; Flt. Sgt. D. C. C. Hinks; Sgt. G. C. Hooper; Flt. Sgt. D. C. Imeson; Sgt. G. H. Lyons; Sgt. D. A. Macaulay; P/O. M. H. D. MacDonald; Sgt. J. A. McWilliams; W/O. N. M. Moore; Flt. Sgt. W. V. Pickering; P/O. D. H. Sargent; Sgt. C. R. Spratt; Sgt. R. E. Stageman; Sgt. G. K. Sutherland; Sgt. J. O. Waltenbury.

KILLED ON ACTIVE SERVICE.—Sgt. D. G. Allen; Flt. Sgt S. Bocking.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. P. F. M. Cooke; Sgt M. J. Cronin; Act. Flt. Lt. A. G. Herbert; Sgt. J. F. Lewthwaite; Sgt. D. L. Rhodes.

MISSING.—Sgt. I. G. Stewart; Sgt. A. G. Sutherland; Sgt. A. O. Tabor.

KILLED ON ACTIVE SERVICE.—Sgt. J. W. Beaven; P/O. K. H. I. Easton; Sgt. J. W. Keane; P/O. A. D. Mackay; Sgt. W. H. Smeaton.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Act. Sgt. R. S. Daniels; 2/Lt. E. W. J. Fripp.

MISSING.—Capt. K. R. Coster; Air Sgt. E. D. King; Lt. L. H. Murrow; Lt. E. F. Wakeling.

Indian Air Force

KILLED IN ACTION.—Sgt. G. J. Arya; P/O. Z. B. Sanjani.

Casualty Communiqué No. 162

Royal Air Force

KILLED IN ACTION.—Sgt. B. H. Cosby; Sgt. A. McColl; P. O. J. K. McIvor; Sgt. E. K. Roberts; Sgt. K. J. Ross; Flt. Sgt. A. R. Tipple; Sgt. H. Weller.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. E. G. Martin.

MISSING.—P/O. E. G. H. Allen; Sgt. B. R. Anstee; Sgt. R. F. Ashby; P/O. T. R. Ashton; P/O. W. H. Baber; Sgt. D. Bagley; Act. Sqn. Ldr. R. G. A. Barclay, D.F.C.; Sgt. O. Barraclough; Sgt. D. Berger; Flt. Sgt. W. S. Blackadder; Sgt. E. E. Blythe; Sgt. F. C. Bond; Sgt. D. G. Brimfield; Sgt. R. Bush; Sgt. R. H. Callaghan; Sgt. E. H. Cooper; Sgt. K. J. Cooper; P/O. R. O. Cordall; Sgt. N. W. Dawkins; Sgt. I. MacL. Dawson; Sgt. D. F. Dobson; Sgt. A. T. Drysdale; Sgt. H. L. Duckworth; Sgt. B. Earnshaw; Sgt. B. L. Ellis-Buxton; Sgt. R. A. Evans; Sgt. J. H. Fletcher; Sgt. D. G. Fuggle; Flt. Sgt. L. T. W. Grady; Sgt. J. Grant; Sgt. J. G. Green; Sgt. T. A. Grey; Sgt. L. T. Grimshaw; Sgt. E. N. Grimwood; P/O. M. W. Groves; P/O. H. C. Hain; Sgt. J. C. Harold; Sgt. W. C. P. Harfoot; Flt. Lt. J. N. Harris; Sgt. L. D. Harris; Sgt. J. C. Highfield; Sgt. E. F. Holmes; Sgt. R. Howells; Sgt. K. Hudson; Sgt. J. Hunter; Sqn. Ldr. J. R. Hyde, D.F.C.; Sgt. P. H. Jackett; P/O. W. A. J. Johnson; Sgt. G. M. Jones; P/O. J. R. Kay; Sgt. J. A. Knox; F/O. J. C. D. Langley; Sgt. W. A. B. Laughlin; Sgt. C. G. Leitch; Sgt. G. R. Lewis; Sgt. R. L. Lloyd; Sgt A. C. Lovegrove; Flt Lt. D. S. S. Low; Act. Flt. Lt. W. R. McKay; P/O J. E. Maple; P/O. F. J. Mee; W/O. P. E. Merralls, D.F.M.; Sgt. J. Mc P. Milligan; Sgt. J. I. C. Morris; P/O. C. R. Morrison-Jones; Sgt. R. H. Moses; Sgt. J. F. O'Brien; Sgt. S. J. Oertel; Flt. Lt. W. B. Orr; P/O. R. M. Patterson; P/O. J. D. Peel; Sgt. M. A. Penstone; Wing Cdr. M. V. Peters-Smith, D.F.C.; Sgt. G. A. Prag; Sgt. K. S. Revell; Flt. Sgt. J. G. Richardson; Sgt. A. J. Roberts; Sgt. L. Robinson; Sgt. E. Sarene; Sgt. A. C. Savory; F/O. P. C. Sayce; Sgt. C. T. Shepherd; Sgt. I. D. Singer; Flt. Sgt. A. G. Smith, D.F.M.; Sgt. W. Smith; Sgt. L. A. C. Standen; Sgt. J. V. Straffen; P/O. G. A. Strasser; Flt. Sgt. J. Tales; P/O. H. Taylor; Sgt. T. R. Thomas; Sgt. F. A. W. Thorne; Act. Flt Lt. F. M. Thorne; Flt. Sgt. G. T. Thornton; Sqn. Ldr. H. R. Tidd; Sgt. R. Vandersteen; Sgt S. W. Walliter; Flt. Sgt. L. West; Sgt. R. C. West; P/O. K. J. Williams; Sgt. P. J. Withers; Sgt. C. Wood; Sgt. S. Woodman; Sgt. E. L. G. Woods.

KILLED ON ACTIVE SERVICE.—Sgt. F. S. Akerman; Cpl. J. Mc.I. Ashley; F/O. C. J. E. Boustead; P/O. G. M. Brearley; Flt. Sgt. J. Brooks; Sgt. W. Connelly; Sgt. N. G. Crabtree; Sgt. H. Curson; Sgt. J. Forbes; L.A/C. G. Gray; Flt. Sgt. D. Gregory; Flt. Lt. M. W. Hamlyn; Sgt. R. J. Haynes; P/O. J. F. Helgason; F/O. P. R. E. Jenkins; A/C.1 W. L. King; P/O. B. J. Leader; P/O. H. M. McKiernan; P/O. N. Macleod; P/O. P. L. Moxey; Cpl. C. H. Odle; P/O. W. T. S. Perryman; Sgt G. E. Proctor; L.A/C. F. Rogers; Sgt. C. S. K. Shepherd; Flt. Sgt. G. J. Smith; L.A/C. R. L. Smith; Flt. Lt. R. W. Stokes; Sgt. E. L. Taylor; Sgt. F. J. Tranter; Sgt. E. G. Travis; L.A/C. J. S. Williams; Act. Cpl. J. K. Wray.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. A. Dickinson; Sgt. W. Ramsden; Sgt. A. J. Hawksworth.

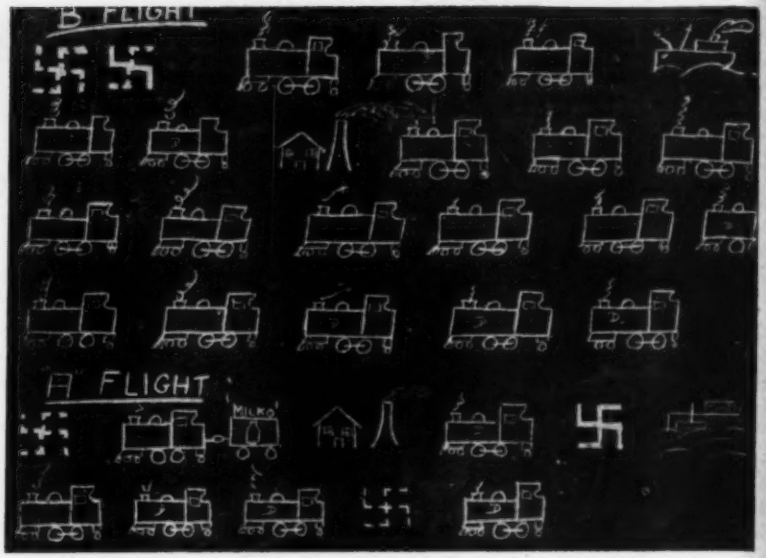
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. G. C. Holt.

DIED ON ACTIVE SERVICE.—Sqn. Ldr. J. H. C. Harrold; L.A/C. E. D. Jenkins; Flt. Lt. I. G. Lennox; Flt. Sgt. E. Taylor; A/C.1 G. J. Watson; A/C.2 B. J. Wilmot.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. W. Baxter.

WOUNDED OR INJURED IN ACTION.—Sgt. A. L. Lovell.



The score board of an intruder squadron showing a nice collection of aircraft, ships, railway engines and factories.

MISSING.—Sgt. W. A. Allsopp; Flt. Sgt. F. W. Beste; Act. Flt. Lt. G. H. Burgess; Sgt. J. H. Caldwell; P/O. D. L. Furphy; Sgt. H. E. Gaskell; P/O. T. E. Jones; P/O. D. P. Leigo; P/O. W. A. Lowing; Flt. Sgt. D. B. Mills; Sgt. W. H. Nettle; Sgt. R. C. Stewart-Moore.

KILLED ON ACTIVE SERVICE.—Act. Sgt. N. L. J. Bundara; Sgt. R. Groom; Sgt. J. J. Manderson; P/O. W. Mofflin; P/O. C. G. Riley; Sgt. R. D. Roberts; P/O. K. Slater.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. G. R. C. Davis; Flt. Sgt. A. J. McPhee.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. J. M. McDonald.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. S. S. Glassecock.

MISSING.—Sgt. E. A. Anderson; Sgt. J. K. Baker; Sgt. W. E. Brown; Flt. Sgt. H. E. V. Bruce; Flt. Sgt. F. Y. Campbell; P/O. G. A. Cooper; P/O. J. F. Day; Sgt. R. S. Doherty; Sgt. J. P. Doyle; Flt. Sgt. C. E. Evans; P/O. W. S. Findlay; Sgt. J. B. Fleming; Sgt. E. J. H. Gurr; Flt. Sgt. H. B. Hamilton; Sgt. J. W. Irish; Sgt. V. R. Lenichek; Sgt. R. K. McGrath; F/O. W. A. McMurchy; Sgt. W. E. Mander; Flt. Sgt. W. L. Maxim; P/O. J. D. Mullins; Flt. Lt. W. W. Murray; Sgt. R. A. Myers; Sgt. B. V. Pearce; Flt. Sgt. W. A. Penney; Sgt. J. B. Pleasance; Flt. Sgt J. V. Potter; Sgt. R. B. Prentice; Sgt. G. W. Roney; Sgt. D. McR. Ross; Sgt. J. Ross Sgt. H. R. Russell; W/O. W. T. Sargant; Sgt. F. M. Van Geun; Flt. Sgt. P. O. Webster; Sgt. R. Wishart; Sgt. T. A. Withers.

KILLED ON ACTIVE SERVICE.—Sgt. R. M. Boates; Sgt. W. N. Reeves; Sgt. A. F. Roberts.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. W. G. T. McKay.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. J. T. Blease.

WOUNDED OR INJURED IN ACTION.—Sgt. J. H. Hodsell.

MISSING.—Flt. Sgt. N. A. Bryson; Sgt. L. T. Cairns; Sgt. N. E. R. Carrel; W/O. B. M. Cook; Sgt. R. P. Coppersmith; Sgt. P. M. Gawith; F/O. N. E. Hodson; Sgt. C. V. McPherson; Sgt. A. W. Pierard; Sgt. S. D. Ross; P/O. P. C. Spittal.

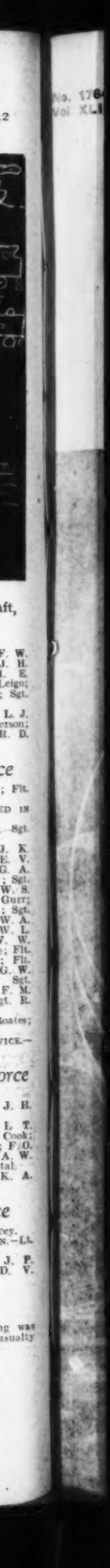
KILLED ON ACTIVE SERVICE.—P/O. R. K. A. Andrew.

South African Air Force

KILLED IN ACTION.—Major D. V. D. Lacey.

MISSING, BELIEVED KILLED IN ACTION.—Lt. A. M. Duncan; Lt. F. L. Stevens.

MISSING.—2/Lt. C. H. Allen; 2/Lt. H. J. P. Lemmer; Air Sgt. S. Liastam; Lt. A. D. V. Morum; Air Sgt. L. Murray.

Official Correction

It is regretted that Sgt. A. Mannering was erroneously reported killed in action in Casualty Communiqué No. 154.